ENVIRONMENTAL IMPACT REPORT
ON THE
NOVATO BUS FACILITY
GOLDEN GATE BRIDGE, HIGHWAY AND TRANSPORTATION DISTRICT

JUNE, 1974

STATE OF CALIFORNIA

STATE CLEARINGHOUSE NUMBER (If any) (1-5)	TRANSACTION ID:

SEE INSTRUCTIONS ON REVERSE SIDE

01	APPLICANT AGENCY RESPONSIBLE FOR REPORT (12-63) GGBHTD	DIVISION (64-72) Engineering		DATE THIS FORM SUBMITTED (73-74) MO. DAY YEAR	
02	ADDRESS (12-63) NOVATO BUS YARD			AGENCY ACTION DATE (IF KNOWN) (75-80) MO. DAY YEAR	
03	ADDRESS (12-63) Box 9000 Presidio Station	CITY (64-90) San Francisco, Ca.	COUNTY (61-75) San Francisco	ZIP CODE (76-80) 94129	
04	CONTACT PERSON (12-30) Peter Claimos	TITLE (37-63) District Secretary	AREA CODE (65-69) 415	PHONE (70-75) 346-5858	EXT. (76-80)

(12-71) PROJECT DESCRIPTION OF NATURE, PURPOSE, BENEFICIARIES

05 Construction of Bus Parking Facility, including Asphalt

06 (12-71) Parking area for 54 buses, parking area for 64 automobiles

07 (12-71) small office structure of 1600 sq. ft. covered fueling facility

08 (12-71) and storage tanks, automated bus washing facility, and

09 (12-71) access road

10 (12-71)

ON THESE 6 LINES CAPSULIZE PROJECT DESCRIPTION. YOU ARE ENCOUPAGED TO ATTACH ADDITIONAL INFORMATION ON THE PROJECT FOR THE BENEFIT OF THE REVIEWER. IF YOU DO, THE STATE CLEARINGHOUSE WILL NEED 25 COPIES OF ANY ATTACHMENTS. PLEASE CHECK WITH THE METROPOLITAN CLEARINGHOUSE FOR THEIR SUBMISSION REQUIREMENTS.

11 PROJECT LOCATION CITY (12-45) Novato — PROJECT LOCATION COUNTY (46-75) Marin

	FEDERAL FUNDS		MATCHING FUNDS		(46-55) OTHER NON-FEDERAL FUNDS	(57-65) TOTAL FUNDS
	GRANT (12-22)	OTHER (23-29)	STATE (30-40)	LOCAL (32-42)		
12	525,333		262,667			788,000

13 SOURCE OF OTHER FEDERAL FUNDS (12-34) | FED. CATALOG NO. | SOURCE OF STATE MATCH (35-57) | SOURCE OF OTHER NON-FED. FUNDS (58-8) Golden Gate Bridge

14 FUNDING AGENCY PROGRAM TITLE (12-60) Urban Mass Transportation Act | FEDERAL CATALOG NUMBER

15 FUNDING AGENCY NAME (12-45) Department of Transportation, UMTA | SUB-AGENCY (46-75) Urban Mass Transportation Administratio

16 CONGRESSIONAL DISTRICT | SENATE DISTRICT | ASSEMBLY DISTRICT | STATE-WIDE | COUNTY-WIDE | LOCAL

17 TYPE OF ACTION:
- [X] 12 NEW
- [ ] 13 MODIFICATION IN CURRENT GRANT - CUR. SCH. NO. _____ (14-21)
- [ ] 22 CONTINUATION GRANT SCH. NO. FROM PRE. YR. _____ (23-30)
- [ ] 31 RECIPIENTAL IF A PRE APPLICANT - PRE. SCH. NO. _____ (32-39)

PROJECT SUBJECT TO REVIEW UNDER: (CHECK AS MANY AS APPROPRIATE)
- [ ] 58 U.S. OFFICE OF MANAGEMENT AND BUDGET CIRCULAR A-95
- [ ] 59 MODEL CITIES PLANNED VARIATION
- [ ] 60 NATIONAL ENVIRONMENTAL POLICY ACT
- [X] 61 CALIFORNIA ENVIRONMENTAL QUALITY ACT
- [ ] 62 SUBDIVISION REVIEW (SECTION 11550.1 OF BUSINESS & PROFESSIONS CODE)
- [ ] 63 STATE ADMINISTRATIVE MANUAL (SEC. 6011)
- [ ] 64 HEALTH RELATED (SEC. 437.5 OF HEALTH AND SAFETY CODE)
- [ ] 65 LEASE OF STATE LANDS
- [ ] 66 OTHER: _____

IF PROJECT IS PHYSICAL IN NATURE OR REQUIRES AN ENVIRONMENTAL DOCUMENT, LIST THE U.S. GEOLOGICAL SURVEY QUADRANGLE MAP IN WHICH THE PROJECT IS LOCATED.
1. Novato
2. _____
3. _____
4. _____
5. _____

PROPOSED FUND START July, 1972 (40-45) MON - DAY - YEAR
FUNDS DURATION 36 (46-48) MOS.
EST. PROJECT START July 1,1974 (49-54) MON - DAY - YEAR
EST. PROJECT DURATION 12 (55-57) MOS.

DOES YOUR AGENCY HAVE A CIVIL RIGHTS AFFIRMATIVE ACTION POLICY AND PLAN? YES [X] 67 NO [ ] 68

WILL THE PROJECT REQUIRE RELOCATION? YES [ ] 69 NO [X] 70

18 IS ENVIRONMENTAL DOCUMENT REVIEW REQUIRED? YES [XX] 12 NO [ ] 13

IF YES -
- [ ] 14 ENVIRONMENTAL IMPACT STATEMENT (REPORT) ATTACHED
- [X] 15 DRAFT EIR [ ] 16 FINAL EIR
- [ ] 17 NEGATIVE DECLARATION ATTACHED
- [ ] 18 NONE ATTACHED - DOCUMENT WILL BE FORWARDED ON APPROXIMATELY MON DAY YEAR (19-24)

IF NO -
- [ ] 25 FEDERAL PROGRAM DOES NOT REQUIRE AN ENVIRONMENTAL DOCUMENT
- [ ] 26 PROJECT EXEMPT UNDER STATE CATEGORICAL EXEMPTION. CLASS _____ (27-28)

19 LIST LOCAL, COUNTY-WIDE, REGIONAL, STATE OR FEDERAL AGENCIES WITH WHICH COORDINATION HAS BEEN ACCOMPLISHED.

City of Novato
No. Marin County Water Dist.
Novato Sanitary District
Bay Area Air Pollution Control District
Calif. Dept. of Transportation
Regional Water Quality Control Board

SIGNATURE OF AUTHORIZED REVIEWING OFFICIAL

SPONSORING PROJECT I.D. NUMBER (OPTIONAL) (12-21)

DRAFT ENVIRONMENTAL IMPACT REPORT

NOVATO BUS FACILITY

Novato, California

Prepared for the

Golden Gate Bridge, Highway

and Transportation District

The preparation of this report has been financed in part through a grant from the United States Department of Transportation, Urban Mass Transportation Administration, under the Urban Mass Transportation Act of 1964, as amended.

by

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June 1974

TABLE OF CONTENTS

PLATES AND FIGURES

APPENDICES

INTRODUCTION

On September 28, 1973, the Golden Gate Bridge, Highway and Transportation District (GGBHTD) adopted a policy goal stating "...during the peak commute hours, 50% of commuters should be carried by transit and 50% by automobiles, by the year 1980, in order to facilitate long range planning; ... for interim planning purposes, the goal of the District shall be to prevent further increases in Bridge traffic congestion, during commute hours, by adding additional transit as the resources of the District permit..." (for the complete text of Resolution 7960, November, 1973, see Appendix 1).

This policy has been established with the encouragement of various municipalities, civic groups and individuals. As an outgrowth of studies beginning in 1965, the Marin County Transit District (MCTD) developed a plan (adopted in 1969) with several key objectives, among them the following: (1)

a) a reduction of present levels of commuter traffic congestion
b) encouragement of a bus transit system
c) enhancement of the visual appearance of the buses and bus facilities.

The bus parking facility in Novato is a part of the program designed to fulfill the above objectives by extensive express service from neighborhoods of Marin and Sonoma

communities to Highway 101 and into San Francisco. Presently the District's fleet of 182 buses is headquartered in new facilities in San Rafael where 126 buses are parked and where maintenance and washing are provided for the entire fleet. The remaining buses are located in Santa Rosa and on a temporary site in Novato. Stage I of improvements to the Santa Rosa site are completed (grading and paving) with Stage II to begin during the summer of 1974 (fueling and washing facilities). Site studies are currently under way for an additional parking area in Petaluma.

The long range plans provide for a centralized administration and maintenance facility in San Rafael with bus parking both at San Rafael and at smaller decentralized parking facilities in Santa Rosa, Petaluma and Novato, which will provide daily fueling and washing. This scheme of satellite facilities is designed to increase the efficiency of the bus system and to insure a high standard of maintenance essential to enhance the physical appearance of the buses.

This draft environmental impact report has been prepared according to the guidelines adopted by the Golden Gate Bridge, Highway and Transportation District Board of Directors which follow the guidelines for implementation of the California Environmental Quality Act of 1970 as amended December 17, 1973. These regulations are found in Title 14, Division 6 of the California Administrative Code.

It should be noted that this document is a draft environmental impact report on a development plan, not on a specific construction project; hence detailed specifications have not been developed by the project design team.

The Resources Agency guildelines (Section 15147) state that

> "The degree of specificity required in an EIR will correspond to the degree of specificity involved in the underlying activity which is described in the EIR."

EXECUTIVE SUMMARY

The Golden Gate Bridge, Highway and Transportation District proposed to develop a bus parking, washing and fueling facility on a 5.46 acre site north of Olive Street and adjacent to the west side of the Highway 101 by-pass in Novato, California. This facility is part of the Golden Gate Bridge, Highway and Transportation District's long range plans to provide regularly scheduled, efficient and clean buses to residents of Marin and southern Sonoma counties.

The project would consist of initial construction of an asphalt parking area (4 acres) for 54 buses and 64 automobiles, a small office building (1600 square feet), a covered fueling facility, and an automated bus washing facility. An access road to the site from Olive Avenue will be constructed along an extension of Railroad Avenue. An additional 1.46 acre parcel remains for future development. The proposed project conforms to adopted local, county and area zoning plans.

The 4 acre filled portion of the site has been in use by a contractor for CALTRANS during the construction of the Novato by-pass, and is covered with construction equipment and debris. The remainder of the site is presently an unused area covered with annual grasses and weedy plant species typical of a disturbed area. A drainage ditch flows through

the middle of this portion of the site to Rush creek, which parallels the railroad and eventually drains into San Francisco Bay.

The major adverse visual and noise impact of the facility will be on Elm Court residents, whose backyards abut the property to the south.

A second major visual impact will be on southbound travelers along the Novato by-pass, who will view a large, unbroken expanse of black asphalt. Of additional concern is the impact of the facility lighting on highway drivers.

There will be a beneficial impact on Highway 101 by the provision of better bus service resulting in fewer commuter cars. There will be a negative impact on Olive Avenue traffic because of the bus traffic; however, this will not be significant as the bus schedules are staggered.

Other impacts have been found to be not significant.

Suitable mitigations have been proposed for all adverse impacts.

I. PROJECT DESCRIPTION (Section 15141)

A. Site Location

The proposed site for the Novato bus facility is located in the older downtown area of Novato, Marin County, California, as shown on the Site and Vicinity Map, Figure 1.

The site is bounded by the following properties:

- to the north by the North Marin County Water District offices and storage yard;
- to the east by the new State Highway 101 Novato by-pass;
- to the south by Elm Court, a small residential development fronting on Olive Avenue, and a pumping station for Sanitary District #6;
- to the west by Railroad Avenue and the Northwestern Pacific right-of-way.

The proposed site totals approximately 5.46 acres consisting of two principal parcels, Assessors Parcel #143-021-50 and #143-72-19.* As currently envisioned, and as shown in Figure 1, the District would build on the filled portion of the property totaling some 4 acres. The remaining unfilled portion will be left for future expansion. Access to the site from existing Highway 101 would be from Olive Avenue along an access road, formerly called Railroad Avenue.

B. Project Objective

The project objective as outlined in the introduction is to provide a bus parking, fueling and washing facility in Novato which will optimize the storage, movement and operation of new and existing buses for the Golden Gate Bridge, Highway and Transportation District.

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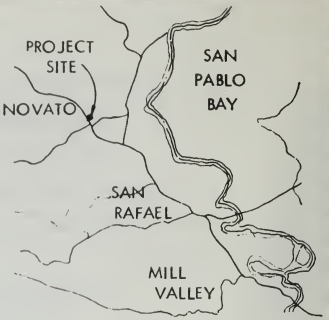
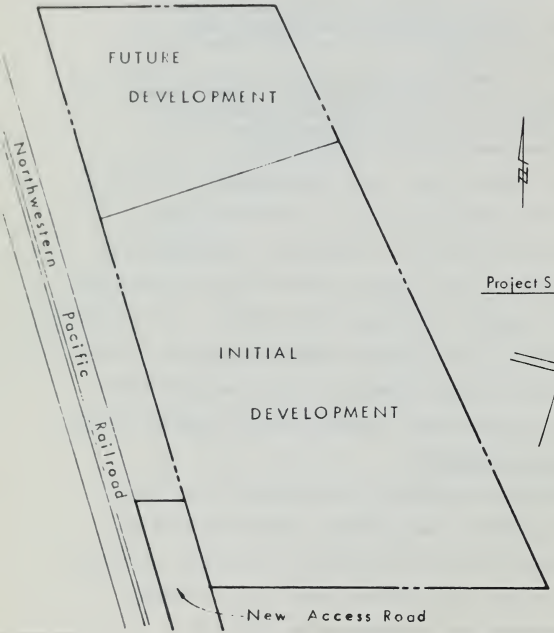
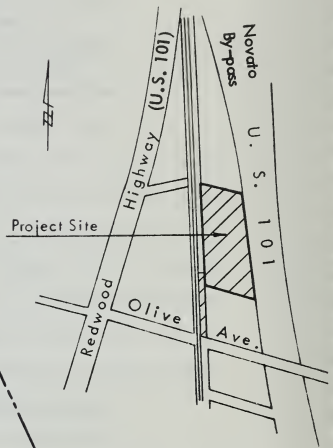
* Official Assessors Parcel Map, Assessor's Office, Marin County.



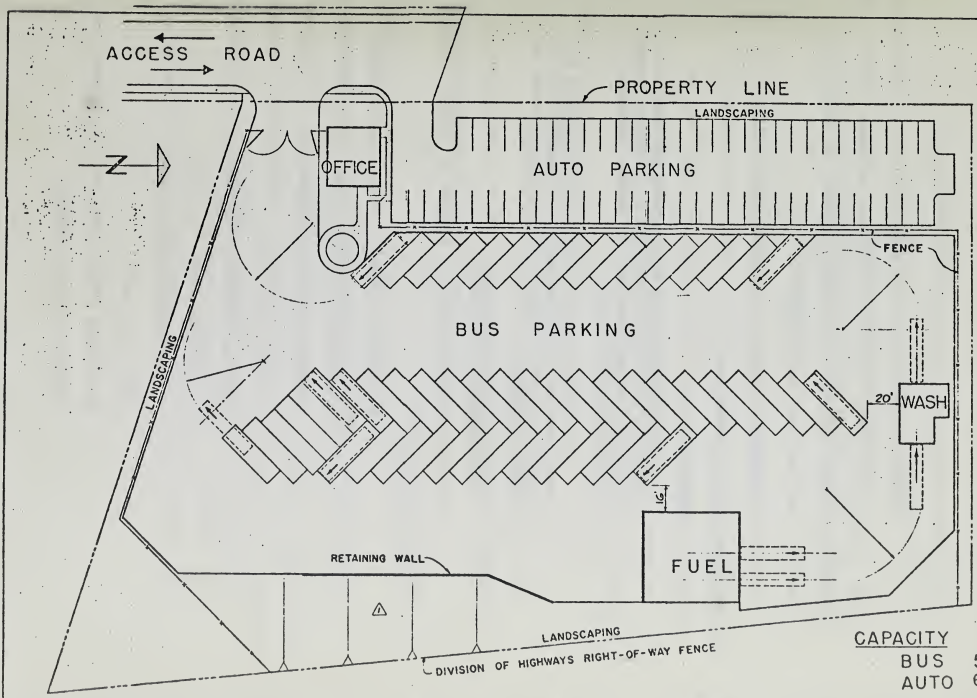
Regional Map





Vicinity Map

MADRONE ASSOCIATES P.O. BOX 2970 · SAN RAFAEL, CALIFORNIA	PROJECT LOCATION Novato Bus Facility Golden Gate Bridge Highway and Transportation District	PLATE 1



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GOLDEN GATE BRIDGE, HIGHWAY AND TRANSPORTATION DISTRICT
BUS MAINTENANCE FACILITY - NOVATO

SITE PLAN

2

Administration and bus maintenance will be carried out in the San Rafael facility with bus parking, fueling and washing divided between facilities located in San Rafael, Novato, Petaluma and Santa Rosa.

The Novato bus facility has been designed to achieve the following goals:

Goals:

. To increase the efficiency of the District's transit activities in Marin County through the application of modern transit planning methodologies.

. To help achieve the District's goal of providing a fifty percent load capability of commute travel demand through non-automotive means by 1980.

C. Description of Project

The project, as seen in Figure 2, would consist of the following:

* an asphalt parking area for 54 buses,
* an asphalt parking area for 64 automobiles,
* a small office structure of 1600 square feet,
* a covered fueling facility with an underground storage capacity of 24,000 gallons of diesel fuel,
* an automated drive-through bus washing facility, and,
* an access road from the site along Railroad Avenue to Olive Avenue.

Also included in the project are the following:

* a chain link fencing surrounding the site,
* lighting poles and fixtures,
* landscaping (type, variety and amount to be determined).

The GGBHTD District plans to develop the site in two stages; the first stage involves immediate development of the four acre filled portion; the second stage involves future development of the 1.46 acres portion which will required additional fill. The 1.46 acre area will accommodate an additional 20 buses.

D. Zoning

According to the City of Novato, the site is currently zoned M-1-H (light industrial) and the project is in conformance with that designation.(2)

Lands in proximity to the project site have several zoning designations, and are listed below:

* to the north, North Marin County Water District's storage area - zoned A-2 (limited agriculture),
* to the west across the railroad right-of-way land - zoned M-1-H,
* to the south, Sanitary District #6 pumping station - zoned M-3 (planned industrial), and the residential area of Elm Court and Olive Avenue - zoned R-1:B-1 (single family residential),
* to the east, the new State Highway 101 Novato bypass.

E. Conformance to Adopted Plans

The Project has been examined with respect to the 1973 Novato General Plan, the Marin Countywide Plan and the Metropolitan Transportation Commission's Regional Transportation Plan and was found to be in conformance with the policies set forth in each. More specifically, listed below are policy statements taken from the above mentioned documents which were applicable to the project.

Novato General Plan

* The City shall encourage expanded bus service within the Novato Area.
* The City's local street standards shall be flexible, so that it is possible to adapt streets to specific site characteristics.

Marin Countywide Plan

* The local mobility shall remain at approximately that reached in 1972.
* Needed mobility will be provided by a greatly expanded bus transit system.

Metropolitan Transportation Commission's Regional Plan

* The speed, frequency and service efficiency of transit shall be increased to enable it to compete with the automobile as a feasible and attractive choice.
* Major transit service improvements shall be made within congested core areas of the region.
* Programs shall be developed to induce greater use of transit to meet peak-hour travel demands in major travel corridors including provisions for convenient automobile and bicycle parking facilities at major transit stops, and assurance of adequate feeder service.
* Decisions regarding transportation programs shall protect natural resources and environmental and social values of the region.

In addition, Novato has indicated on its Transportation Map the desired route for an express right-of-way for buses. This route would be contiguous to the existing railroad right-of-way and therefore border the proposed site.

II. DESCRIPTION OF THE EXISTING ENVIRONMENT (Section 15142)

A. Physical Setting

1. Visual

The visual appearance of the portion of the proposed site to be developed is one of a filled, neglected site presently covered with construction equipment and debris. The site is encircled by the Northwestern Pacific Railroad to the west; the North Marin County Water District office and corporation yard to the north; the slightly elevated Novato by-pass to the east; the backyard of 4 homes which face on Elm Court, a small residential development, and a pumping station for Sanitary District #6 to the south. The filled portion of the site is currently being used by a contractor for CALTRANS for equipment storage (trailers, grading equipment, etc.). A grass and wildflower covered hillock is located in the southeastern portion of the filled area adjacent to the highway and near the Elm Court homes. A drainage ditch with patches of cattails cuts across the unfilled portion of the site to the north. The remainder is covered by a variety of upland vegetation such as thistles, wild radish, and several annual grasses, typical of disturbed soils. Assorted abandoned construction debris, old truck tires, etc. litter the filled and unfilled portions of the site.

2. Noise - (Summarized from Appendix B)

Regional

The major source of noise in the Novato area east of Highway 101 (Redwood Highway) is that emanating from highway traffic. Other sources are the grain and lumber operations adjacent to Highway 101, the Northwest - Pacific Railroad and the corporation yard of the North Marin County Water District.

Local

Projected ambient noise levels on the proposed site following the opening of the Novato by-pass range are high. Typically noise levels remain relatively constant during the daylight hours and drop during the late night and early morning hours.

Other sources of noise associated with the proposed project site:

1. Traffic on Olive Avenue.
2. Motorcycle traffic.
3. Construction noises associated with the Novato by-pass.

3. Traffic and Access Roadway

Regional

North-south bound traffic in East Marin currently travels through the town of Novato on the old Redwood Highway (State Highway 101); a Novato by-pass segment of Highway 101 is scheduled to open in late 1974.

Average daily traffic counts in both directions on Route 101 north of Grant Avenue were 43,500 in 1972, with 63,000 during the peak month.[3] The peak hour volume averages 5,200 according to counts of CALTRANS. South of Atherton Avenue these counts were 42,500, 61,000 and 5,200 respectively.

Local

Traffic counts for 1972 provided by Marin County indicate a daily 2-way volume of 3,200 on Olive Avenue east of existing Route 101.[3] Weekend counts were 2,300.

Buses to be parked on the proposed project site are currently being parked on a leased unpaved site with access to Olive Avenue and near Highway 101.

Access Roadway

Access to the proposed site is along a 450± extension of Railroad Avenue northerly from Olive Avenue. The extension is presently a dedicated but undeveloped city street. Access to a Novato Sanitary District #6 pump station is along this same street. A North Marin County Water District high pressure water line lies 3 - 4 feet below the natural ground level grade of the Railroad Avenue extension. A drainage ditch, culverts and a P.G. & E. utility pole are located at the corner of the Railroad Avenue extension and Olive Avenue.

4. Climate and Air Quality

Regional - (Summarized from Appendix 3)

The dominant factor that determines the climates of the entire San Francisco Bay Area is its proximity to the Pacific Ocean. The large scale flow of air is such that its path is almost invariably from the ocean. This maritime influence, which tempers the climate, falls off sharply with distance from the ocean and bay waters. The hills to the west of Novato play an important role in channeling the air flow and thus the climate of the local area.

During the summer half of the year - May to October - when there are few storms and the flow along the Pacific coastline is almost invariably from the northwest, much of the marine air reaches Novato via the Golden Gate, rather than directly from the coast. The typical daily flow northward from the Golden Gate spreads laterally with winds increasing throughout the day, diminishing by evening with a weak reverse flow after nightfall.

During the winter months (November to March), the daily wind cycle is not nearly as regular. When storms are approaching, the winds

are typically from the SSW to SSE sector and, as the storms pass, turn to NW. There are about 58 days per year with rain, most of which (53) occur during the November-to-April rainy season. Although the average wind speed is a little less in winter than in summer, the strongest peak speeds occur in winter during the passage of storms. Very weak winds and calm occur with very high frequency in the fall and winter months in the intervals between storms. Thus, in winter, moderate wind speeds - associated with storms - are interspersed with periods of several days of very weak winds.

The high incidence of light winds (less than 3 knots) and calm (almost 50% of the time on an annual basis, mostly between December and February), and the relatively high incidence of fog, haze and smoke in the Fall and Winter (October to February, inclusive) indicate that atmospheric dispersion in the Novato region is often quite poor. The poor dispersion conditions occur primarily in the Winter (December to February, inclusive).

Local

Both the temperature and movement of air in the lowest 50 feet of the atmosphere are largely

determined by the characteristics of the underlying surface The four acres of the project site proposed for the current development have dirt surface with little vegetative cover. The surface is essentially flat with the exception of the 6 to 8 foot elevated by-pass and the hill along the southeastern margin of the property. The 1.46 acres which will remain undeveloped are covered with a variety of vegetation with a small drainage channel. Present atmospheric concentrations of pollutants were not measured on the site but have been extrapolated from data taken in San Rafael. (See Table V., Appendix 3)

The present fleet of buses was manufactured to conform to 1971-72 standards of California Vehicle Code and California Health and Safety Code. The 32 buses now on order will meet the 1973 standards of both codes. It is estimated that Golden Gate Bridge, Highway and Transportation District buses emit less than the code maximums because of the Environmental Improvement Package installed on each bus and the rigid preventative maintenance program.(4)

The principle malodorous substances in the emissions of diesel buses are the sulfur oxides and aldehydes.

At the present time there are no requirements for a vapor recovery system in diesel fueling operations.[5]

5. Geology, Seismicity and Soils

Regional

The site is located within an alluvium-filled valley underlain by bedrock of the Franciscan assemblage typical of many areas of northern Marin County. The Franciscan is the major geologic unit found in most of Marin County and in the northwestern part of California. It consists of a wide variety of sedimentary, metasedimentary and volcanic rocks which were originally deposited in a marine-type environment during Jurassic-Cretaceous time (approximately 70 - 180 million years ago). After consolidation, extensive tectonic activity folded and faulted the rocks into the rugged terrain common to the northern California coastal area. (See Geologic Map - Plate 3)

The nearest known fault believed to be active is the Healdsburg - Rogers Creek fault approximately 8 miles to the northeast. The active San Andreas fault is approximately 12 miles to the west. Inactive faults are believed to be present in the Novato area. The Novato Valley fault is located below the alluvium in Novato Valley.[6] The Burdell Mountain fault is located approximately 1½ miles east of the site.

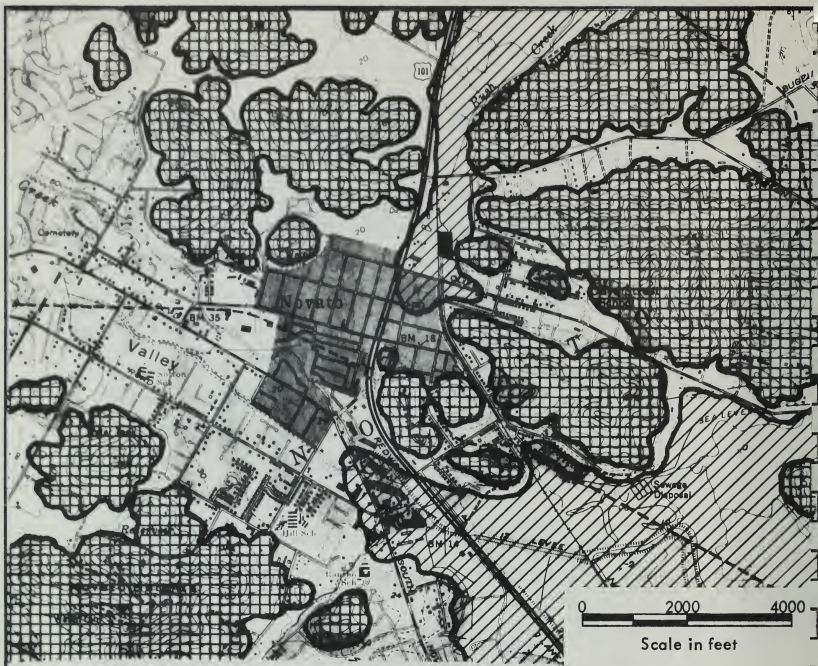
Most of California is regarded as being in a high seismic risk zone. Future earthquakes in the Bay Area will be felt on the site; however, the intensity of ground shaking will depend on the distance to the epicenter and the earthquake magnitude. Generally, ground shaking from earthquakes can produce various forms of surface failure. These failures are most usually associated where weak soils are present along with high ground-water levels. Lateral spreading, lurch cracks, differential compaction or densification, ground cracking and soil liquefaction are common effects of intense ground shaking.

Rush Creek, the major drainage course in the area, flows north to the Petaluma River. Level marshland north of the site may have extended into Novato at one time.

Local

The proposed terminal is located on a low-lying level area in the north central part of Novato. The property has been filled and graded. Drainage channels up to seven feet deep are located to the west and north of the site.

The fill, covering most of the site, was placed upon alluvium believed to thicken towards the western margin. According to a recent soil investigation



Explanation

Bay Mud Deposits - unconsolidated sandy silt and clay

Alluvium - unconsolidated sandy clay, gravelly clayey sand

Franciscan Formation-undifferentiated - consolidated sandstone, chert, greenstone, shale

Faults; inactive, concealed under alluvium and bay mud deposits

Site Location

Ref: Berkland, J.O. - Geology of the Novato Quadrangle . MS Thesis Jan. 1969

MADRONE ASSOCIATES P.O. BOX 2970 · SAN RAFAEL, CALIFORNIA	GENERALIZED GEOLOGIC MAP Golden Gate Bridge Bus Maintenance Facility Novato, California	PLATE 3

the fill appears to be well compacted, and up to 5½ feet in thickness and adequate to support shallow spread footings for the planned structures.[7] The alluvium consists of generally sand clays to gravelly sands. Thickness of the alluvium is generally greater than 25 feet. Bay investigation indicates the presence of stiff clays which may represent the borders or limits of bay mud deposits. Outcrops of the bedrock were observed in road cuts to the east and west of the site. The rock is typically a deeply weathered sandstone which, although highly deformed, appears quite competent with no apparent weak zones.

The compacted fill and the unconsolidated alluvium will respond to ground shaking much more than consolidated bedrock but much less than weak soils such as marsh deposits. The potential for the unconsolidated alluvium layer to liquefy during earthquakes is greatly reduced due to the presence of the thick overlying layer of clay which normally cannot liquefy. The ground-water table is approximately seven feet below the surface. No evidence of active faulting was observed in the vicinity of the site and none is reported in recent geologic literature covering the area.[7]

6. Hydrology

Regional

Runoff from the surrounding hills of

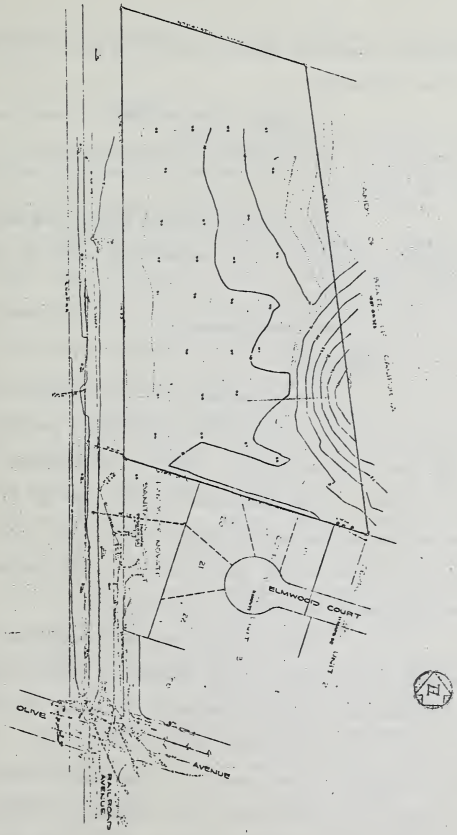
the Novato Basin is carried through a system of pipes, drainage canals and naturally occuring creeks to San Francisco Bay. The majority of the city's surface waters flow to the southwest into the Novato Creek flood plain. Generally, lands north of Delong Avenue drain in a northeasterly direction into Rush and Basalt Creeks, Black John Slough, the Petaluma River and eventually into San Francisco Bay.

Site Characteristics

The proposed site is generally level and slopes slightly from the southeast to the northwest. Run-off drains into deep drainage ditches on the west and north sides of the property. The ditch to the east forms the beginnings of Rush Creek. The small hill on the eastern portion of the property drains onto the site.

In its present state it is estimated that 50 - 65% of the rainwater flows off the site.(8) Peak 24-hour rainfall during the last 3 years amounted to 2.93 inches.(9) Using a 4 acre impervious surface factor and a maximum 24-hour rainfall total of 5 inches, an off-site peak flow of 1.6 acre feet/24 hours can be projected. This amount is regarded by the Flood Control division of the Marin County Department of Public Works as insignificant.(10)

A review of the grading and drainage plans for the Novato bypass east of the site shows them



MADRONE ASSOCIATES P.O. BOX 2970 · SAN RAFAEL, CALIFORNIA	TOPOGRAPHIC MAP Novato Bus Facility Golden Gate Bridge Highway and Transportation District	PLATE **4**

to be adequate, and that there will be no run-off from the highway onto the site.

Drainage from the new access road will flow directly into the adjacent ditch paralleling the eastern boundary of the site.

The existing catch basin and drains in the adjacent Elmwood Court residential area will not be involved in the project.

7. Natural Environment

Regional

The terminal site is located on the former low, flat grazing lands which are now almost entirely covered by the city of Novato. Vestiges of former natural conditions point to the existence at one time of a grassland - oak savannah extending to the south, west, and for a short distance into hills to the east, and draining gradually into the Petaluma River Basin to the north.

The lowlands are surrounded by hills which become progressively more wooded on upper slopes, forming continuous woodlands made up of coast live oak, such deciduous oaks as black, valley and Oregon, with bay, madrone and buckeye also present in the plant community. The understory includes poison oak, snowberry, honeysuckle, hazel, and herbaceous plants typical of the San Francisco Bay - Pacific Coast Range community. Slopes exposed to south or west, or characterized by shallow soils, are covered by

grasslands or open oak woodland, grading into a savannah formation.

Local

There is almost no biotic continuity remaining between the immediate site of the terminal and the surrounding undeveloped lands of Novato except for aerial routes of dispersal and migration. Because the land has been highly altered by fill, or at least disturbed, and surrounding lands have been developed for both residential and industrial purposes, there is no evidence on the site of any native plants. The entire association of plants consists of herbaceous annuals and, where fill has not been placed, perennial "weeds", typical of wastelands and of near-by grazed grasslands. The major part of the site is without vegetation of any kind, herbs, shrubs or trees. A list of plant species may be found in Table I. (Appendix 4) Any wildlife which occurs within the site or utilizes it must be either small and limited in its habitat requirements, or very mobile, such as birds or rodents. Two small areas within the site can be considered to have limited habitat value: the seasonal drainage ditch, and approximately 800 square feet paralleling the west boundary, where well established perennial grass - Hrading bunch grass - provides a habitat for meadow mice and perhaps a few common snakes - gopher and/or western garter.

No rare or endangered species were found on the site. All other habitat values of the site can be considered to be of a transitory nature, associated with urban wastelands. Such habitats are temporarily exploited for food and limited shelter, but can be considered expendable and replaceable.

8. Archaeology and History

Regional

Novato has inhabited at the time of historical contact by an ethnographic population known as the Coast Miwoks of the Penutian language family.(11) Nels Nelson recorded a number of archaeological sites in the Novato area in 1907; one of them being 4-Marin-192, which was in the area of the proposed bus parking facility.

In more recent times, Fernando Feliz (sometimes spelled Felix or Fales) received the two square league Rancho Novato in 1839 from Governor Juan B. Alvarado(See Fig.5) The eastern portion, now called Black Point was largely salt marsh, the western part pleasant valleys and hills. His immediate homestead in the rancho was described at the time as "safe...and remote from wild Indians".(12) Feliz exchanged his land for a few head of varied livestock in 1844. The buyer, Jacob Leese, brother-in-law of General Vallejo, started a chain of ownerships two years later. Proper ownership transfer was confirmed by the California District Courts in 1854. Feliz, Leese, Simmons, Sweetser and DeLong all one time owners of Rancho

Novato, remain as street names today.

Local

Archaeological site 4-Marin-192 was excavated in 1964-65 by John McBeath and today there is nothing left of the Indian midden[13] which was the home of a prehistoric population of the Middle and Late Horizon.[14]

Francis DeLong developed Rancho Novato with orchards, vineyards, tenant dairy farms and reclaimed 2,000 acres of marshland in Black Point. By 1892, however, Senator DeLong had neglected his land and had incurred debts beyond his means to pay. He let over 10,000 acres west of the highway to Henry Pierce to pay off private creditors. The Black Point area east of the highway, heavily mortgaged to the Home and Farm Company, was auctioned off in five and ten acre parcels and town lots.[15] The bus parking facility area become a portion of the Cerro Vista subdivision.

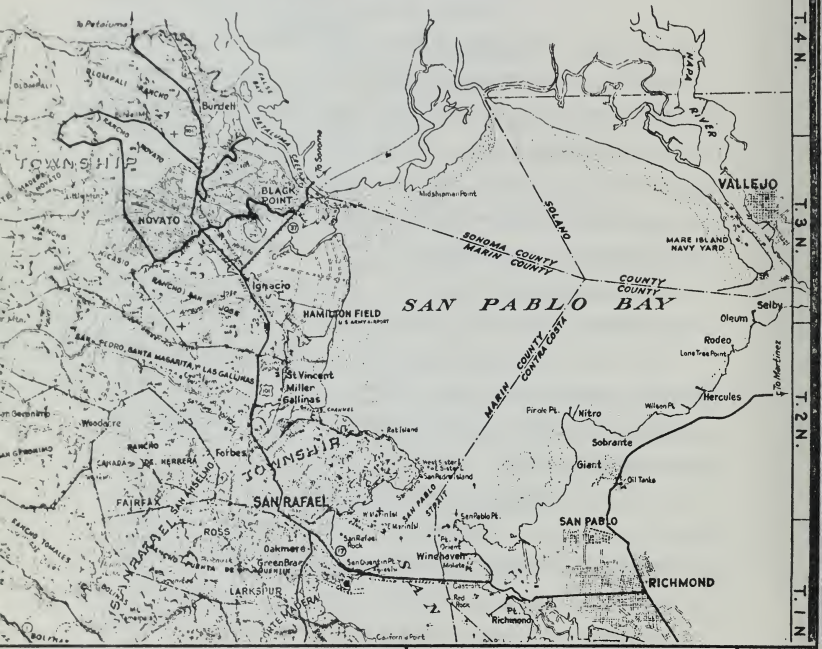
The farm house of Charlie Brown, noted by Nels Nelson in his 1907 archaeological survey, stood on a knoll just north of Cherry Street between Armstrong and the highway By Pass.[16] It is now gone.

Rare or Unique Resources

Archaeological site 4-Marin-192 which occupied the proposed bus parking facility was excavated in 1964-65.[13] None of it remains today. There appears to be nothing of historical importance to preserve on or near the proposed project site.

METSKER'S MAP
OF
MARIN COUNTY
CALIFORNIA

SCALE ½ IN. = ONE MILE
COMPILED BY METSKER MAPS
111 SO TENTH STREET, TACOMA, WASH
1020 THIRD AVE., SEATTLE, WASH.



MADRONE ASSOCIATES
P.O. BOX 2970 · SAN RAFAEL, CALIFORNIA

TOWNSHIP MAP

Mexican Rancho Lines - 1834 - 46

PLATE 5

B. Socio-economic

1. Economic

a. Fiscal

The 1973-74 tax rate in the project area is $11.393 per $100.00 of assessed valuation.[18] The project site is currently assessed at $22,500 for the total 5.46 acres. This generates $2,563.44 in tax revenues to the taxing agencies as follows:

Marin County at 2.58 rate	$ 580.50
City of Novato at .95 rate	213.75
Novato Unified (Gen. Purpose) at 4.423 rate	995.18
Marin Community College at 1.056 rate	237.60
Other School - incl. bonds at .719 rate	161.78
Other Districts - incl. fire at 1.665 rate	374.63
TOTAL TAX REVENUE	$2563.44

The value of the average residence in Novato is approximately $35,000.[17] The value of Elm Court houses, adjacent to the project site, is estimated from $21,000 to $24,000.

b. Employment

In 1970, Novato, the largest city in Northern Marin County, had a population of 31,000.(17) In 1974, the population was estimated to be 35,000.

In the past, residents of the area worked primarily at Hamilton Air Force Base, Novato, and in the surrounding communities of Northern Marin and southern Sonoma County. During the past two decades, and accentuated by the recent closing of Hamilton Air Force Base, work locations have changed. Today Novato serves as a bedroom community for residents who work throughout the northern San Francisco Bay Area. Many commute daily to San Francisco.

2. Community Services

Community services are provided by:

- The City of Novato - administrative planning, police protection, public works and roads;
- Novato Fire District - fire protection;
- North Marin Water District - water supply;
- Sanitary District #6 of Marin County - sewage disposal
- Novato Unified School District - education services, kindergarten through high school;
- Marin Community College District - junior college and adult education services;
- The Golden Gate Transit District - transportation.

a. Water

A moratorium on water will be in effect in Novato until the District's water project is completed.

in 1976; however, water service can be provided to the project site according to exceptions stated in Regulation 14, Section C 2 (7/17/73).

> "(1) ...new connections may be made to the water distribution system of the District as follows;... (2) new connections to the existing water distribution system which require a meter size not larger than one inch;"
> (For the complete Regulation, see Appendix 1)

While water service does not extend into the project site, a North Marin County Water District main is located at the junction of the project access road and Olive Avenue. A 1" meter can be located either at this location or near the proposed administration building on the site. (19)

The 20 gallon/minute provided by a 1" meter will be sufficient to provide 4000 gallons/day, the estimated maximum requirement of the facility.

The North Marin County Water District anticipates summer curtailment of water for some users until the District's current water project is completed in 1976. Water for the bus wash may be included in such a category.

Joint funds for a joint wastewater reclamation and reuse program are being sought by the North Marin District and the Novato Sanitary District. Should this project go forward, recycled water could be made available for the bus wash from a line which would parallel

the Novato Bypass.

b. Sewage

Sewer service facilities from Marin County Sanitary District #6 extend into the project area and are considered adequate to handle the anticipated demand.(19)

In order to preserve existing capacity from uses it deems "non-essential", the District has enacted an ordinance which reads in part:(*1)

> "...the managers may require that the applicant for any permit which includes a car wash within the facilities to be covered by said permit provide facilities for reclamation and reuse of all or a portion of the water used in the car wash process..."

3. Community Profile

In planning jargon the community of homes that lie immediately south of the project area on Olive and Elmwood Avenues is generally referred to as an "impacted" area. That is, they have been surrounded by land uses which are usually detrimental to or incompatible with residential areas. An existing rail road right-of-way and sewage pumping station border the community to the west. Of possibly much greater impact is the soon to open Novato by-pass which comes within 40 feet of several homes to the east. The majority of undeveloped land in the vicinity of the residences is zoned for light industrial use - which is generally incompatible with residential areas.

(*1) Sanitary District Code, Section 812 as amended June 14, 1972. Regulation is included in Appendix 1.

In order to get a rough estimate of the effects of these "incompatible" uses of the residential area and to predict what additional impact, if any, might arise from the proposed project, questions were asked of the Elm Court residents concerning length of residency, ownership of homes, ages and appropriate income. When combining the results of the questionnaire with censes data,[17] a limited kind of profile can be drawn. On the positive side there is a high percentage of home ownership (85% verses 15% renting). Adult occupants' ages are widely spread across the age spectrum (youngest 23, oldest 55, mean 37). On the negative side, however, there has been a marked increase in the turnover rate within the last six months. Four of the sixteen homes were sold an a fifth owner is contemplating moving. It is unknown precisely what impact the highway construction had on those that have left, but it is assumed to have been a principal or contributory cause.

Other negative factors include:

* The neighborhood has one of the lowest average assessed valuations of any in Novato, with the exception of Hamilton Air Force Base.

* The average income of the residents is of the lowest in Novato with the exception of employees at the Air Force base.

III. ENVIRONMENTAL IMPACT (Section 15143)

A. The Environmental Impact of the Proposed Action

1. Visual

*The major long term visual impact of the bus parking facility will be on southbound travelers on the Novato by-pass of Highway 101. From a point north of the facility and opposite the NMCWD property, the facility will appear as a large unbroken area of asphalt paving broken primarily by a small office building, refueling and bus washing equipment, and a fence separating the auto and bus parking areas. Light poles and fixtures will be clearly visible and will break the line of the horizon. Lighting will be visible at night.

*A second major long term visual impact will be on residents of Elm Court whose houses are adjacent to the facility. The entire facility will be in plain view with the office building and row of parked buses predominant. Buses entering and leaving the facility will travel past the backyards. Light poles and fixtures will be clearly visible. Lighting will be visible at night.

*There will be some visual impact to residents of the trailers west of the Northwestern Railroad.

*There will be a short term visual impact resulting from construction activities.

2. Noise (Summarized from Appendix 2)

*There will be a negligible long term impact resulting from the bus wash.

*There will be a negligible long term impact on Elm Court residents resulting from the bus pass-by.

*There will be a great short term impact resulting from construction activities.

3. Traffic and Access Road

*The major regional long term impact of the bus facility will be the removal of cars from Highway 101 during peak commute hours.

*The major local traffic impact will be from buses travelling on Olive Avenue. The arrival and departure schedule for buses indicate a maximum of ten inbound and eight outbound in a one-half hour interval. These peak volumes are not significant in terms of road capacity.(21)

*Should buses be unable to make the turn on to Olive Avenue from the access road and remain within the proper lane, there will be an additional impact on Olive Avenue traffic.

*The arrival and departure of employees (drivers) will not have a significant impact on Olive Avenue traffic as their hours will be staggered to match the bus schedules.

4. Climate and Air Quality (Summarized from Appendix 3)

*There will be an almost undectable impact on climate (less than 1° F. beyond 1000 feet from the property line).

*Levels of NO_2 may exceed current standards at distances of less than 100 feet along the southeast boundary during peak hours of bus operations.

*Levels of HC and CO will not exceed air pollution standards even under severe meterological conditions.

*Odors from diesel bus emissions will not be detectable beyond 70-80 feet even under severe meterological conditions.

*There will be no detectable air pollution from the fueling operation.

5. Soils and Geology

*No active faulting was observed in the vicinity of the site none is reported in recent geologic literature.

*Severe ground shaking from earthquakes might result in surface cracking, and/or settlement from densification and differential compaction.

*With proper site preparation and engineering design, there will be no significant impact on the project from soil conditions.(6)

6. Hydrology

*The installation of four acres of impervious material will result in an increase of runoff from 50-65% to 90%. During times of peak rainfall this could result in an off-site flow of 1.6 acre feet. This is not considered a significant impact in view of the total capacity of the drainage system.

*There will be a slight impact on the quality of the run-off water from contaminants carried from the paved parking area.

Substances associated with parking areas include:

A. Petroleum derivatives from fuel, lubricants, and hydraulic fluid leaked from the vehicles.
B. Particles worn from tire and brake linings.
C. Rust, plastic and soil particles.
D. Various components of asphalt and paint.

*There will be no impact on run-off water quality from the water used in the bus washing facility,as this water will be collected in the sewer system.

7. Natural Environment

*There will be little impact on wildlife other than that associated with a few patches of annual grasses and weedy species growing on the four acre portion of the site to be developed.

*There will be no impact on wildlife living on or visiting the 1.46 acre portion that is to remain undeveloped other than that impact resulting from construction activities.

*No rare or endangered species were found on the site.

8. Archaeology

*No archaeological sites remain at the proposed site.

9. Socio-Economic

a. Economic

*There will be a $2,563.44 property tax loss to local taxing agencies since the Golden Gate Bridge, Highway and Transportation District is exempt from property taxes.

*There will be a long term increase in maintenance and construction costs to the City of Novato due to the heavy use of Olive Avenue by buses.

*There will be a real but immeasurable increase in Novato real estate values resulting from more efficient bus service and a less congested Highway 101.

*There will be an immeasurable decrease in property value of the adjacent Elm Court houses. The nearby freeway is concurrently depressing the values of these homes. Values may increase as the property is considered for industrial use.

*There will be some possible impact on employment in the Novato area resulting from additional Golden Gate Bridge, Highway and Transportation District bus facility personell.

b. Community Services

(1) Water

*The impact of the bus washing facility on the water supply of the North Marin County Water District will not be significant.[19] The water demand anticipated for the bus washing operation is as follows:

	No.of buses to be washed each day	Total volume of water at 100 gallons/bus wash	Equivalence to single family households
Winter	34	3400	3-4
Summer	17	1700	2-3

*The impact of water required for rest room facilities will not be significant. There will be no full time employees on the site.

(2) Sewage

*The impact of the bus washing operation on facilities at Sanitary District #6 will not be significant.[20]

*The impact of the rest room facilities are not significant.[20]

B. Any Adverse Environmental Effects Which Cannot Be Avoided If The Proposal Is Implemented.

*The major adverse long term visual impact of the proposed site will be the extensive expanse of asphalt paving with light poles and fixutres. (As viewed from the Novato by-pass or from the Elm Court houses.)

*A major adverse short term acoustic impact will be during the three to four week period of grading and paving.

*Other adverse impacts real or potential will result from:

- Buses entering and leaving the facility (acoustic and visual).
- Buses traveling on Olive Avenue (traffic and economic).
- Some vegetative loss.
- Some tax revenue loss.
- Increased water usage.

Some increase in air pollutants from buses.

C. Mitigation Measures Proposed to Minimize the Impact

A number of mitigation measures are outlined in this section which are designed to specifically address impacts listed in the above section. A number of potential impacts have been mitigated in the early design of the facility such as siting the bus wash and fueling operations away from the Elm Court residences, the tentative placement of landscaping, etc.

1. Visual

a. Screening and Landscaping

(1) Coordinate landscaping with the California Division of Highways. Money has been allocated for landscaping along the Novato by-pass and the highway landscape architects have expressed a desire to cooperate with the Bridge District's landscape architect.(22) Since the view of the distant Novato Hills is so splendid from the southbound by-pass lanes, a low three to four foot shrubby type of landscaping is recommended. This will effectively block out a view of the bus facility in the foreground, yet not obscure the view of the background hills.

(2) Provide effective screening for residents of Elm Court.

A fence would be the most effective screening, both visually and psychologically. A continuation of the fencing constructed by the Sanitary District along the access road is recommended.

(3) Landscape with small fruit sized trees along the fence which will provide Elm Court residents additional screening from the lighting fixtures and the glow of light, yet will not obscure the view of the Novato Hills from the southbound lanes of the Novato 101 by-pass.

(4) Provide vegetative landscaping for the office building. This will diminish the large expanse of asphalt by attracting the eye towards the building.

(5) Landscape along the fence separating the bus and auto parking will also aid in breaking up the "sea" of asphalt effect.

(6) Plants selected for landscaping should have the following characteristics: low maintenance (pruning, shedding, etc.), low water requirements and high auto and bus exhaust resistance. Native plants are usually preferred over exotics. Plants should provide some habitat requirements for birds such as berries, seeds, nesting material or cover.

(7) Buildings and structures should be "designed not to be seen".[8] Building materials and finishes should be selected to minimize the visual impact, e.g. textured surfaces are preferred over smooth, earthtones over bright colors, etc.

(8) The bus washing equipment should be enclosed structurally or by landscaping if effective landscaping along the highway is not provided.

b. Lighting

(1) Because of the sensitive location of the facility, certain general criteria for good lighting should be closely followed.[23] Among these are the following:

(a) Lights should be shielded and directed.
(b) The light should be a pleasant color.
(c) The height of the light fixtures should be kept low. (40 feet maximum, 30 feet is preferred.) More poles with lower light fixtures are preferred over fewer poles with high fixtures.

(2) Specifications found in the 1972 State of California Vehicle Code Regulation 214665 regarding lighting adjacent to highways should be closely followed. (See Appendix A) Cut-off type lighting shall be installed so as not to produce an objectionable glare outside the property. Direct glare will result from light emanating from the lamp and fixutre; indirect glare will result from diffuse reflection from structures, vehicles, walls, lighting poles, etc. The indirect glare at the property line adjacent to the residential areas resulting from the total parking area shall not exceed 0.1 footcandles initial maximum average with a 0.3 footcandles initial maximum point.

(3) The placement of light poles and fixture adjacent to the property line of the Elm Court houses should be avoided.

2. Climate and Air Quality

a. In order to reduce the emissions of NO_2

within the terminal, buses should not be permitted to remain stationary with engines idling for more than one or two minutes. If this rule is followed, the NO_2 levels predicted in the vicinity of the terminal under severe conditions will be reduced to less than half.*1

b. Sulfur oxides and aldehydes (the principle malodorous substances) can be greatly reduced by proper engine care, i.e. more complete combustion in the combustion chamber of the engine which will eliminate the dark plume from the exhaust.*1

3. Geology and Soils

Design for settlement, foundations and paving for the access roadway and the facility should be carried out according to recommendations in the Soils and Foundation Investigation Report. Harding-Lawson Associates, March 27, 1974.(7) Such engineering design will minimize the impact of earthquakes and provide adequate foundation support.

4. Traffic and Access Road

a. The design of the access road shall enable arriving or departing buses to remain in the proper lane on Olive Avenue.

b. A minimum of three feet of covering shall remain above the North Marin County Water District's high pressure water line.

5. Hydrology

Factors that should be considered in designing the drainage plan are as follows:

a. Appropriate local agencies should be contacted to ensure the drainage plan for the terminal facility is compatible with that of existing facilities and satisfies local ordinances.

b. The drainage plan should be designed to accomodate peak run-off from a 100 year storm.

c. All run-off water from the developed portion of site, including that of the hill to the east should be collected and removed through a system of catch basins and pipes to the drainage channels to the west and north. Design of this system should insure that this additional water will not overburden the existing drainage channels.

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*1 A spokesman for the GGBHTD states that buses are not permitted to idle while stationary for more than 1 or 2 minutes and that there is a rigorous engine maintenance program.

d. Surface waters from the new access road will have to be disposed of so as to prevent overburdening the existing drainage facilities at the corner of Olive and Railroad Avenues.

e. Curbs along the access road should not exceed present elevations in order to insure an unobstructed flow or run-off into Rush Creek from Elmwood Court.

f. The portion of the property to the north that will be left undeveloped may require some minor grading to prevent ponding of surface waters. The area should be graded to drain toward the drainage canals to the north and west.

g. A trap system to separate out sand and floatable oils from bus wash water should be installed according to local sanitary district regulations.

h. Proper cleaning of the pavement surfaces should be a routine procedure. This would include the use of modern equipment and the proper training of personnel. The amount of material accumulated is directly related to the length of time between cleanups.(25)

6. Water

a. Because of a real short term water shortage and an inherent long term water shortage, measures to conserve water should be carried out routinely.

b. On-site recycling of bus wash water is not suggested as a mitigation because of the fact that the heaviest water usage occurs during the winter months, and because of the volume/equipment cost ratio. The total annual water cost is estimated at around $450. Recycling equipment cost estimates range from $20,000 upward for installation. In addition, maintenance costs for the recycling equipment have been found to be high at the San Rafael site.(24)

c. Should recycled water become available from the North Marin County Water District's reclamation and reuse project, the District should plan to make use of this supply.

d. Low volume, shallow trap water closets should be installed.

e. Landscaping with small water requirements and high air pollution tolerance should be installed.

f. An emergency exit to Atherton Avenue via North Marin County Water District property should be considered. The Water District has expressed an interest in exploring the possibilities of such an arrangement.(19)

D. Alternatives to the Proposed Action

1. No Project

Long range plans of the Golden Gate Bridge, Highway and Transportation District call for increasing the efficiency of the bus transit system according to modern transportation methodology. The establishment of satellite parking, fueling and washing facilities in Novato, Petaluma and Santa Rosa is part of the Golden Gate Bridge, Highway and Transportation District long range plan. Without the Novato site, buses would operate out of the San Rafael site with the following effects:

Additional bus mileage for established routes.
Additional "deadhead" operation.(*1)
Additional fuel consumption.
Additional air pollution.
Additional time for each route.
Additional pay for drivers.

2. Alternate Site in Novato

In 1971 six different sites were investigated in the Novato area by Bridge District staff and the advantages and disadvantages of each site weighed carefully.(26) The following parameters were included in the considerations:

a. Estimated costs for acquisition and development.

b. Location relative to and access to Highway 101 and the by-pass.

c. Safety factors in bus/traffic interface.

*1 Deadhead operation means passengerless travel to and from bus routes.

d. Compatibility with adjacent land owners.
e. Amount of "deadhead" travel distance to the various sites.

The proposed site was recommended as the preferred site and the recommendation was endorsed by the Novato Planning Director.

An alternate site in Novato recommended in this study involved a less direct routing to Highway 101 through a residential neighborhood. This site was deemed less desirable because of the additional "deadhead" travel distance and the routing through a residential neighborhood.

3. Alternate Site in Petaluma

An alternate site in Petaluma would result in the same additional factors listed under the no project alternative such as "deadhead" travel time, fuel, driver pay, etc. With no site in Novato, a larger site would be required in Petaluma with increased fuel and washing facilities. While the initial outlay of funds might be reduced, the operational costs in time and money would be increased by this alternative.

E. Relationship Between Short Term Uses and Enhancement of Long Term Productivity

This section of an Environmental Impact Report is reserved for a consideration of the relationship between man's short term use of the land and the natural long term productivity of an ecosystem expressed in a time frame of hundreds of years. Man's past activities on this site made such a consideration moot. Novato was indeed once rich,productive land with both marshes and flat bottom land; however, the

growth of the city and the accompanying actions of diking, filling, paving, etc. have irreversibly destroyed any potential long term productivity.

F. Any Irreversible Environmental Changes Which Would Be Involved in the Proposed Action Should It Be Implemented

- Redesign and paving of the Railroad Avenue extension access road.
- Paving of approximately four acres of the proposed site.
- Installation of lighting fixtures, a bus wash and fueling facility, construction of an office building.

The construction of the bus parking facility further commits this parcel of land to man's activities; however, the pursuit of an efficient bus system is intended to alleviate a matter of environmental concern - increasing commuter traffic and the concommitant increase in air pollutants and fuel usage.

G. The Growth-Inducing Impact of the Proposed Action

In that the majority of buses to be parked at this facility are already in service, there will be no growth inducing impact from the project, per se. In that there will be an increase in the efficiency of operation resulting from construction of the proposed facility, more commuters are likely to use the bus transit service; thus traffic on Highway 101 will be reduced. For this reason such a project might be considered to be growth-permissive,rather than growth-inducing.

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PEOPLE AND ORGANIZATIONS CONSULTED
During the Preparation of this Report

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George Juilly, Landscape Architect, California Department of Transportation.

John Lai, Traffic Projections, California Department of Transportation.

Jerry Belden, Belden, Inc., Electrical Consulting Engineers.

John Holm, Sverdrup and Parcel and Associates, Inc.

Larry Kolb, Regional Water Quality Control Board.

Jim Talbot, Bay Area Pollution Control District.

Appendix 1

Ordinances and Policies

a. Resolution 7918 - Golden Gate Bridge, Highway and Transportation District

b. Regulation 14 - Water Shortage Emergency Regulations

c. Ordinance #33 - Marin County - June 14, 1972

d. State of California Vehicle Code 1972, Section 21466.5

GOLDEN GATE BRIDGE, HIGHWAY AND TRANSPORTATION DISTRICT

RESOLUTION NO. 7960

AMENDMENT TO
RESOLUTION NO. 7918

November 9, 1973

WHEREAS the Rules, Policy and Industrial Relations Committee has so recommended; now, therefore, be it

RESOLVED that amendment of Resolution No. 7918 be and it is hereby authorized, to include "car pooling" and "staggered working hours and days," as additional means to move 50% of commuters by transit and 50% by automobile by the year 1980, in order to facilitate long range planning.

ADOPTED this 9th day of November, 1973, by the following vote of the Board:

AYES: Directors Bettini, Daubeneck, Ellington, Fraser, Gonzales, Lerer, Lucius, Meyer, Tamaras and Wornum; President Leonoudakis

NOES: None

ABSENT: Directors Castner, Del Carlo, Guidotti, Mazzola, Molinari, Moskovitz and Pelosi.

President

Attest: Secretary

GOLDEN GATE BRIDGE, HIGHWAY AND TRANSPORTATION DISTRICT

RESOLUTION NO. 7918

POLICY ON DISTRICT OBJECTIVE TO MOVE 50% COMMUTERS BY TRANSIT BY 1980

September 28, 1973

WHEREAS the Rules, Policy and Industrial Relations Committee has so recommended; now, therefore, be it

RESOLVED that the Board of Directors of this District does and hereby establishes a policy goal whereby, during the peak commute hours, 50% of commuters should be carried by transit and 50% by automobile, by the year 1980, in order to facilitate long range planning; and be it further

RESOLVED that for interim planning purposes, the goal of the District shall be to prevent further increases in Bridge traffic congestion, during commute hours, by adding additional transit as the resources of the District permit, and as determined by the Board of Directors, with the proviso that statistics covering the morning commute periods, cover the hours of 6:00 a.m. to 10:00 a.m.; and be it further

RESOLVED that the Motion of the Board of Directors meeting of September 12, 1969, concerning this subject, be and it is hereby rescinded.

ADOPTED this 28th day of September, 1973, by the following vote of the Board:

AYES: Directors Bettini, Castner, Daubeneck, Del Carlo, Edington, Fraser, Lucius, Meyer, Molinari, Tamaras and Wornum; President Leonoudakis.

NOES: None

ABSENT: Directors Gonzales, Guidotti, Lerer, Mazzola, Moskovitz and Pelosi.

A1 (2)

REGULATION 14
WATER SHORTAGE EMERGENCY REGULATIONS

a. Effective Period and Applicability

This regulation is effective on May 1, 1973, the date the Board of Directors by resolution declared that a water shortage emergency condition prevails throughout the District except the portions thereof in the western part of Marin County. This regulation shall continue in effect until the supply of water available for distribution within said area has been augmented sufficiently to meet the demands of said area and the Board of Directors finds and declares that said water shortage emergency condition has ended. This regulation shall not apply to those portions of District in the western part of Marin County denominated Annexations 2, 3, 5, 6, 7 and 8, and known as Olema, Point Reyes Station, Inverness Park, Oceana Marin and territories on the east shore of Tomales Bay.

b. Limit on New Connections

New connections to the District's water distribution system authorized after July 17, 1973 shall be limited to such number that the quantity of water to be furnished by the District through such new connections shall not exceed 360,000 gallons per day based on District forecasts of use during the average day of July in 1976.

c. Exceptions

Anything in Section b. of this regulation to the contrary notwithstanding, new connections may be made to the water distribution system of the District as follows:

(Continued)

(1) new connections solely for fire hydrants;

(2) new connections to the existing water distribution system which require a meter size not larger than one inch;

(3) new connections pursuant to the terms of connection agreements which, prior to the effective date of this regulation, had been executed, or had been authorized by resolution of the Board to be executed, on behalf of the District;

(4) new connections made pursuant to amendment of connection agreements previously executed provided that the quantity of water to be furnished by the District is not thereby increased;

(5) new connections for use of quantities of water made available by reason of rescission of unperformed connection agreements.

d. Supercedes Other Regulations

During the effective period of this regulation, it shall supercede and control over any other regulation of the District in conflict herewith.

ORDINANCE NO. 33

AN ORDINANCE AMENDING ORDINANCE NO. 14 OF SANITARY DISTRICT NO. 6 OF MARIN COUNTY, THE SANITARY CODE OF SANITARY DISTRICT NO. 6 OF MARIN COUNTY, ADOPTED SEPTEMBER 27, 1954, AS AMENDED.

The Sanitary Board of Sanitary District No. 6 of Marin County, California, does ordain as follows:

Section 1. Sec. 611, Sec. 711, Sec. 713 and Subsection (a) of Sec. 910 of Ordinance No. 14, the "Sanitary Code of Sanitary District No. 6 of Marin County," adopted September 27, 1954, as amended, relating to maintenance of backwater prevention devices, improvement security, partial reimbursement for off-site sewers, and collector sewer charges, shall be, and they are hereby, amended to read as follows:

"Sec. 611. Backwater Prevention Devices—Maintenance. Where a side sewer serves plumbing fixtures that are located less than one (1) foot above the rim elevation of the upstream manhole or rod hole in the reach of main sewer into which the side sewer connects, it shall be protected from backflow of sewage by installing a backwater prevention device of a type and in the manner prescribed by the Manager. Any such backflow device shall be installed by the applicant for sewer service at the sole cost and expense of the applicant. The maintenance of the backflow device shall be the sole obligation of the permittee or his successor in interest. The District shall be under no obligation to ascertain that the backflow device continues in operating condition."

"Sec. 711. Improvement Security. Prior to issuance of a permit for public sewer construction, the applicant shall furnish to the District a faithful performance bond, cash, or other improvement security acceptable to the District Board, in the amount of the total estimated cost of the work as determined by the District Engineer. Such faithful performance bond, cash deposit, or other improvement security shall be conditioned upon the performance of the terms and conditions of the permit and, unless more stringent requirements are otherwise specified by the District Board, shall guarantee the correction of faulty workmanship and replacement of defective materials for a period of one year from and after the date of acceptance of the work by the District Board. The applicant shall also furnish to the District a labor and material bond, or other security acceptable to the District Board, in the amount of the total estimated cost of the work."

"Sec. 713. Partial Reimbursement for Off-Site Sewers. Whenever a public sewer is required to be extended more than 200 feet from the existing public sewerage facilities of the District to the nearest corner or point on the property line of the installer and the District finds that said sewer will potentially serve property other than that of the installer, the installer shall be entitled to an off-site sewer reimbursement credit in an amount determined by the District Board based upon the estimated number of side sewer connections which may, in the future, be made by other property owners to the sewer paid for by the installer beyond the limits of his property.

Any person proposing to construct an off-site sewer, as herein defined, shall submit a written request for a reimbursement agreement to the District Manager not less than two weeks prior to the date of the Board meeting at which Board action is desired. If the Manager finds that the sewer to be constructed may reasonably be expected to benefit properties owned by persons other than the installer, he shall cause a reimbursement agreement to be prepared and submitted to the Board for approval, which agreement shall provide for partial reimbursement for off-site sewer construction through payment to the installer of an amount equal to eighty-five percent (85%) of the Collector Sewer Charges paid to the District pursuant to Section 910 (a) of this Ordinance by others making side sewer connections to the off-site sewer beyond the limits of the installer's property within ten (10) years from the date of acceptance of said sewer by the District. The total amount of said partial reimbursement shall not exceed the installer's entitlement to off-site sewer reimbursement credit as determined above. Payments by the District to the installer will be made in July of each year. Said agreement shall be made and entered into prior to the issuance of a permit for the work by the District."

"Sec. 910. Collector and Trunk Sewer Charges.

(a) Collector Sewer Charge. In addition to any other fees and charges established by the Ordinances, rules and regulations of the District, there shall be collected, prior to connection to the sanitary sewerage system of the District, a Collector Sewer Charge to be paid by persons desiring to connect a side sewer directly to an existing main sewer of the District which was installed without direct or indirect cost to the connecting property with respect to its use as a collector sewer, which charge shall be based upon the required size of connecting side sewer, as follows:

Size of Side Sewer	Amount of Charge
4 inch	$ 400.00
6 inch	1,000.00
8 inch	1,775.00

Provided, however, that in the event the connecting property is within a Special Benefit Zone in which a Special Equalization Charge for collector sewers has been established by the District Board in accordance with Section 907 of this Ordinance, the Special Equalization Charge for collector sewers so established shall be paid in lieu of the Collector Sewer Charge herein provided."

Section 2. Sec. 812, relating to car washes, shall be, and it is hereby, added to Ordinance No. 14, the "Sanitary Code of Sanitary District No. 6 of Marin County," adopted September 27, 1954, as amended, to read as follows:

"Sec. 812. Car Washes. From and after the effective date of this regulation the Manager may require that the applicant for any permit which includes a car wash within the facilities to be covered by said permit provide facilities for reclamation and reuse of all or a portion of the water used in the car wash process and the submittal of plans and specifications for the installation of such reclamation and reuse facilities acceptable to the Manager."

Section 3. All ordinances and parts of ordinances inconsistent herewith are hereby repealed.

Section 4. If any section, subsection, sentence, clause or phrase of this ordinance or the application thereof to any person or circumstance is for any reason held to be unconstitutional or invalid, such decision shall not affect the validity of the remaining portions of this ordinance or the application of such provision to other persons or circumstances. The Board hereby declares that it would have passed this ordinance or any section, subsection, sentence, clause or phrase hereof irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases be declared to be unconstitutional.

Section 5. Upon adoption of this ordinance it shall be entered in full in the minutes of the Sanitary Board, shall be published once in the Novato Advance, a newspaper of general circulation printed and published in the District, and shall take effect immediately upon the expiration of one week of publication.

Passed and adopted at a regular meeting of the Sanitary Board of Sanitary District No. 6 of Marin County, duly held on the 12th day of June, 1972, by the following vote:

AYES, and in favor thereof, Members: deTuncq, Grundstrom, Payne, Rivamonte.

NOES, Members: None.

ABSENT, Members: Hardcastle.

C. B. RIVAMONTE
President, Pro Tem

Attest:
C. A. JOSEPH
Secretary

Publish June 14, 1972.

STATE OF CALIFORNIA

VEHICLE CODE

1972

For Sale at All Offices of the
Department of Motor Vehicles

$1.00 including tax

Light Impairing Driver's Vision

21466.5. No person shall place or maintain or display, upon or in view of any highway, any light of any color of such brilliance as to impair the vision of drivers upon the highway. A light source shall be considered vision impairing when its brilliance exceeds the values listed below.

The brightness reading of an objectionable light source shall be measured with a 1½-degree photoelectric brightness meter placed at the driver's point of view. The maximum measured brightness of the light source within 10 degrees from the driver's normal line of sight shall not be more than 1,000 times the minimum measured brightness in the driver's field of view, except that when the minimum measured brightness in the field of view is 10 foot-lamberts or less, the measured brightness of the light source in foot-lambert shall not exceed 500 plus 100 times the angle, in degrees, between the driver's line of sight and the light source.

The provisions of this section shall not apply to railroads as defined in Section 229 of the Public Utilities Code.

Added Ch. 968, Stats. 1970. Effective Sept. 14, 1970, by terms of an urgency clause.

Prohibited Signs and Devices

21467. Every prohibited sign, signal, device, or light is a public nuisance, and the Department of Public Works, members of the California Highway Patrol, and local authorities are hereby authorized and empowered without notice to remove the same, or cause the same to be removed, or the Director of the Department of Public Works, the commissioner, or local authorities may bring an action as provided by law to abate such nuisance.

Public Utilities

21468. This division does not modify or limit the authority of the Public Utilities Commission to erect or maintain, or cause to be erected and maintained, signs, signals or other traffic control devices as authorized by law.

Chapter 3. Driving, Overtaking, and Passing

Article 1. Driving on Right Side

Right Side of Roadway

21650. Upon all highways a vehicle shall be driven upon the right half of the roadway, except as follows:

(a) When overtaking and passing another vehicle proceeding in the same direction under the rules governing such movement.

(b) When placing a vehicle in a lawful position for, and when the vehicle is lawfully making, a left turn.

(c) When the right half of a roadway is closed to traffic under construction or repair.

(d) Upon a roadway restricted to one-way traffic.

(e) When the roadway is not of sufficient width.

(f) When the vehicle is necessarily traveling so slowly as to impede the normal movement of traffic, that portion of the highway adjacent to the right edge of the roadway may be utilized temporarily when in a condition permitting safe operation.

Amended Ch. 1185, Stats. 1961. Effective Sept. 15, 1961.
Amended Ch. 136, Stats. 1969. Effective Nov. 10, 1969.

Divided Highways

21651. It is unlawful to drive any vehicle upon any highway which has been divided into two or more roadways by means of intermittent barriers or by means of a dividing section of not less than two feet in width either unpaved or delineated by curbs, lines, or other markings on the roadway except to the right of the barrier

Appendix 2

An Acoustic Analysis, Proposed Bus Maintenance Facility, Novato

Job #145500
Report #2455

AN ACOUSTIC ANALYSIS
PROPOSED BUS MAINTENANCE FACILITY
NOVATO, CALIFORNIA

May 1974

M.A. Porter

Submitted to:

Madrone Associates
35 Mitchell Boulevard
San Rafael, California 94574

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The following report presents the rationale, methodologies and conclusions of an acoustical analysis of a proposed bus maintenance facility to be located in Novato, California. The overall program utilized a combination of physical measurements and analytical prediction techniques. The conclusions of the analysis may be summarized as follows.

1) The residential areas to the south of the proposed maintenance facility will be subjected to an increase in the ambient level of approximately 5 to 15 dB(A) during a portion of the construction period. Such an elevation of the ambient would be categorized as *great* impact, as defined in the body of the report.

2) The expected impact due to steady-state machinery operations within the facility, such as the bus wash, would be categorized as *negligible*.

3) The impact due to early morning bus operations, based on an elevation of the existing ambient of less than 5 dB(A), will be *negligible*.

INTRODUCTION

Bolt Beranek and Newman, Inc. (BBN) has been retained by Madrone Associates to prepare an acoustical assessment of a proposed bus maintenance facility to be located in Novato, California. This bus maintenance facility is to be owned and operated by the Golden Gate Bridge Highway and Transportation District. The approximate location of this facility is indicated on Figure I.

It may be observed that the proposed maintenance facility lies adjacent to the right-of-way of the U.S. Highway 101 Novato By-pass. To the west of the proposed maintenance facility lies the Southern Pacific Railroad right-of-way. To the north of the maintenance facility lies an industrial area utilized by the County of Marin, and to the south of the proposed facility is a residential area. The primary emphasis in the following analysis is placed on the acoustic impact of the proposed bus facility on this residential area.

In order to prepare a complete analysis of the acoustic impact due to this proposed new facility, a field measurement program has been conducted. This measurement program included monitoring the acoustic environment for a 24-hour period in the vicinity of the proposed maintenance facility. In addition, numerous field measurements were conducted at the present Golden Gate maintenance facility in San Rafael, California.

The purpose of these measurements was to obtain quantitative data concerning the noise levels associated with the Golden Gate buses and the noise levels associated with the bus wash facility.

Data obtained in the field measurement program were reduced using the appropriate data reduction facilities in our laboratories. These data, along with others from our files, were utilized in the development of ambient noise contours for both the existing condition and those expected with the introduction of the new maintenance facility. These contours, as presented later in the text, represent application of state-of-the-art methodology in the prediction of both the existing noise levels and the noise levels that may be expected upon completion of the proposed facility. The levels developed by these methodologies have therefore been utilized in the assessment of impact due to the proposed maintenance facility.

MEASUREMENT PROGRAM

The sound pressure level was continuously micro-sampled over a 24-hour interval at the location shown on Figure I. The measurements were conducted utilizing the data acquisiton system illustrated on Figure II. These measurements were subsequently reduced in our laboratory utilizing the data reduction system illustrated on Figure III. As is illustrated on Figure II the data were obtained utilizing a micro-sampling technique (e.g., record was produced of only 1 1/2 second out of every 30 seconds in real time). This methodology decreases the data analysis time by a

factor of ten while maintaining the statistical accuracy of the analysis. [1,2]

DATA ANALYSIS PROCEDURE

Data obtained during the measurement program documented both the spectral and temporal characteristics of the noise levels associated with the measurement position. For each one hour period, represented by three minutes of sample data, a statistical analysis was made of the A-weighted sound level. The data obtained from these analyses were utilized as the input to a BBN developed environmental impact analysis computer program. The environmental analysis program computes the statistical level function associated with each sample period. Further manipulation of this function is subsequently utilized in the evaluation of environmental noise.

ANALYSIS METRICS

There are many specific indices that have been proposed and/or used to assess environmental noise impact. [3] In general, however, it has been found that the scheme of predicting human response due to noise must in some way account for the following parameters:

1) The magnitude of the sound
2) The frequency characteristics of the sound
3) The time varying characteristics of the sound

MAGNITUDE AND FREQUENCY CONTENT

The first two parameters may in many cases be qualified by the use of a special electronic weighting network in

the measurement system that simulates the response of the average human ear to sounds of different frequencies. Each frequency of the noise then contributes to the total reading in an amount approximately proportional to the subjective human response associated with that frequency. Measurement of the overall noise with the sound level meter incorporating such a weighting network yields a single number called the A-weighted sound level, or simply dB(A). A recent Environmental Protection Agency document [4] indicates that the A-weighted sound level as a metric is almost universally accepted as an adequate way to deal with the ear's differing sensitivity to sounds of different frequencies.

TIME CHARACTERISTICS

One dominant characteristic of environmental noise is that it is not steady. At any particular location the noise will usually fluctuate considerably; quiet in one instance to loud at the next. Thus we can not simply say that the noise level at a site is "so many decibels." To describe the noise exposure adequately requires a statistical approach. Consequently we should speak of the noise exposure of the site, meaning the whole time varying pattern. The Equivalent Noise Level (L_{eq}) as a measurement for the quantification of environmental noise was developed in both the United States and Europe over a period of years. A concept representing a fluctuating noise level in terms of a steady-state noise having the same energy content is widespread in recent research, such as the Environmental Protection Agency Report on Public Health and Welfare Criteria for Noise [5]. There

is evidence that it accurately describes the onset and progress of permanent noise induced hearing loss [6] and substantial evidence to show that it applies to annoyance in various circumstances [7]. This concept is born out by Pearson's experiments [8] on the trade-off between the number of events and noise level in aircraft fly-overs [9].

L_{eq} is formulated in terms of the equivalent steady noise level (L_{eq}) that in a stated period of time would contain the same noise energy as the time varying noise during the same period.

The mathematical definition of L_{eq} for a time interval defined as occupying the time between two epochs, T_1 and T_2, is:

$$L_{eq} = 10\text{Log} \quad \frac{1}{T_2 - T_1} \int_{T_1}^{T_2} \frac{P(t)^2}{P_0^2} \, dt$$

where P(t) is a time varying sound pressure and P_0 is a reference pressure taken as 20 micropascals.

CHARACTERIZATION OF THE EXISTING ENVIRONMENT

Figure IV illustrates the temporal characteristics of the noise levels as measured at the 24-hour measurement site indicated on Figure I. The bottom line represents the L_{90} (the level exceeded 90% of the time or the background level) and the upper line represents the equivalent noise level, L_{eq}. As may be seen, the noise level remains relatively constant during the daylight hours and drops approximately 10 - 15 decibels during the late night and early morning hours. As indicated on Figure IV, the equivalent noise levels in the hours of 10:00 and 11:00 p.m. are some 6 - 8 decibels higher than might

normally be expected. Examination of the field data reveals that these higher than normal levels are due to the presence of several noisy motorcycles during this period. With the effect of the motorcycles removed, the noise level would follow the dash line shown on Figure IV.

Figure V illustrates the projected peak hour L_{eq} based on the existing traffic flow data for U.S. 101 and Olive Avenue. One may observe that at the measurement location on Olive Avenue, the projection based on traffic flow would be approximately 60 - 65 dB(A). This projection agrees quite well with the measured peak hour sound levels illustrated on Figure IV. We have therefore assumed that noise levels in this region may be modeled utilizing the temporal characteristics illustrated on Figure IV and the spatial characteristics illustrated on Figure V.

In addition to the projected noise levels due to U.S. 101 and Olive Avenue, it is necessary to analyze the projected levels due to the U.S. 101 By-pass when it is opened. To this end, the predicted ratio of traffic in 1995 on the U.S. 101 By-pass and U.S. 101 (4:1)* has been applied to the existing traffic flow on 101 to predict the levels expected when the by-pass is opened in the fall of 1974. These projected levels are illustrated on Figure VI. One may observe that the expected noise environment in the vicinity of Olive Avenue and Elm Court will be dominated by traffic noise from U.S. 101

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* Data supplied by the Novato Planning Department

By-pass.

It must be stressed that the noise contribution from the 101 By-pass illustrated on Figure VI is only an estimate based on projected traffic flows and with no shielding due to the elevation of the expressway taken into account. It is therefore possible that peak hour noise levels due to traffic on U.S. 101 By-pass could be on the order of 5 dB(A) lower than those illustrated.

PROJECTED LEVELS DUE TO THE PROPOSED BUS MAINTENANCE FACILITY

In general there are three categories of noise activity due to the projected maintenance facility which must be analyzed. These categories are:

1) Construction noise
2) Noise associated with the steady-state facility operations
3) Noise associated with the bus traffic in and out of the facility.

Although impact must be based on a composite of the above categories of noise, it is advisable, for the sake of clarity, to examine each source separately in regards to both level and time duration in developing the impact assessment.

CONSTRUCTION NOISE

It is conventional when the analysis of a new project is undertaken, that the construction noise be taken into

account. In the case of the proposed Novato maintenance facility, the major construction activity will be the grading and paving of the parking lot. It is estimated that this procedure will take approximately three to four weeks. Based on information supplied by the Environmental Protection Agency [10], we estimate that the equivalent noise level at the south end of the proposed facility will be approximately 75 dB(A) during this construction phase. The estimated level due to construction sources is approximately 60 dB(A) in the vicinity of Olive Avenue.

STEADY STATE NOISE

The only major source of steady-state noise apparent at the new proposed bus facility will be the bus wash, which is to be located at the north end of the facility. Measurements have been conducted at a similar facility located in San Rafael, California. This facility is nearly identical to the proposed Novato facility with the exception that the bus wash proposed for Novato is not to have side walls as does the one in San Rafael. Taking these factors into account, Figure VII illustrates the expected contribution of the bus wash noise to the community noise in the vicinity of Elm Court. It may be seen that the projected noise levels due to the bus wash in general lie between the L_{90} and the L_{50} levels. Thus we would expect that, during a certain percentage of the time, the bus wash will be audible.

VEHICULAR NOISE

In order to determine the noise levels assocaited with the bus operations in and out of the proposed Novato Terminal, a series of field measurements was conducted at the San Rafael terminal. During these measurements, the pass-by noise level of approximately forty buses was measured as the buses exited from the terminal on their morning runs. These levels were monitored at a roadside positon fifty feet from the center line of the road and approximately 150 feet from the point where the buses leave the San Rafael terminal driveway. Figure VIII illustrates a time-amplitude plot of several bus pass-bys. The loudest level observed during this period for any single bus was approximately 80 dB(A).

It may be observed that the time amplitude pattern of a bus pass-by was approximately triangular. Figure IX illustrates the pass-by of one bus (the same bus indicated by the asterisk on Figure VIII)with an expanded time scale. It may be clearly seen from this illustration that the sound level from a typical bus pass-by does indeed follow a triangular pattern. That is, the noise level varies as a linear function of time.

It may be shown that the equivalent noise level of a series of triangular functions which project above a background noise level may be determined from the following equation:

$$L_{eq} = L_B + 10\text{Log}\left[1 + \frac{n\tau}{T}\left(\frac{10^{\left(\frac{L_{max}-L_B}{2.3}\right)} - 1}{10}\right)\right]$$

where:

L_{eq} = Equivalent Noise Level due to n pass-bys

n = number of pass-bys during time period of interest

τ = time during which the bus noise is within 10 dB(A) of the maximum level

T = time period of interest

L_{max} = maximum level of bus noise

L_B = equivalent noise level in community without bus pass-bys

Examination of this equation reveals that the second terms on the right-hand side of the equation represent the increase in the equivalent sound level in the community due to the bus pass-bys. Table 1 below tabulates the expected increase in community noise level as a function of time both with and without the proposed 101 By-pass in operation.

Novato Bus Terminal
Bus Pass-by Analysis

Hour	Number of Bus Pass-Bys	Existing L_{eq} w/o By-Pass	Existing L_{eq} with By-Pass	Projected Increase in L_{eq} w/o By-Pass	Projected Increase in L_{eq} with By-Pass
0400	2	47	54	5	1
0500	7	53	60	4	1
0600	21	58	65	4	1
0700	3	56	63	1	-
0800	2	56	63	1	-

TABLE 1

ASSESSMENT OF IMPACT

One of the basic underlying reasons for subjective annoyance with noise is that it is an intrusion with respect to the ambient levels that exist or that would exist in the absence of the new noise source. In other words it is often the change in the noise environment rather than the absolute level that causes public reaction. Ambient levels that have existed for some time often come to be accepted as satisfactory or considered to be beyond the control of public reaction. The magnitude of the annoyance will, in many cases, depend on the degree of intrusion that the new noise source bears to the ambient.

One approach to selecting intruding noise criteria is to establish noise level limits based on ambient levels and on the percentage of time the new noise will be audible above the ambient level. The approach utilized in the following assessment of change in environmental noise level has been documented in reference 11. The procedure establishes categories for impact based on the amount by which the new noise will exceed the existing ambient.

The first impact category, designated *negligible* impact, requires that the L_{eq} of the new source be less than 5 dB(A) above the existing ambient. If on the other hand the L_{eq} of the new noise lies between 5 and 15 dB(A) above the existing ambient, the category would be designated *some* impact. A category of *great* impact would result if the L_{eq} of the new noise source lies 15 dB(A)

or more above the existing ambient.

These categories of noise impact are designated as follows:

NEGLIGIBLE IMPACT	The new noise environment generally is not expected to cause annoyance or dissatisfaction.
SOME IMPACT	The new noise environment is expected to be acceptable to most individuals, but there may be some expressions of annoyance or dissatisfaction.
GREAT IMPACT	The new noise environment may be judged as unacceptable by many with expressions of considerable annoyance and dissatisfaction.

This formation of categories of noise impact based on intrusion above ambient levels can only be valid if the existing ambient noise itself does not cause annoyance!

CONSTRUCTION NOISE

As has been previously stated, the noise levels due to construction activities in the vicinity of Elm Court will be on the order of 60 - 75 dB(A). This represents an increase over the ambient of approximately 5 - 15 dB(A). Therefore during the three to four week period during which the grading and paving operation will take place, we would project that the impact on the residents in the area surrounding Elm Court would be *great*.

STEADY-STATE NOISE

As has been illustrated on Figure VII, the noise due to the only major steady-state operation, the bus wash,

is expected to be at or below the L_{50} spectrum level. On this basis we would expect that the noise level due to the bus wash operation would result in a categorization of *negligible* impact due to steady-state operations.

BUS PASS-BY NOISE

Examination of Table I reveals that the maximum projected increase in the L_{eq} due to bus pass-bys would be during the 4:00 a.m. hour under the assumption that the proposed 101 By-pass is not in operation. If the By-pass were in operation and producing noise levels consistent with those illustrated on Figure VI, the maximum increase in the ambient L_{eq} would be reduced to approximately 1 dB(A). Thus we would judge that the impact due to the bus pass-bys will be *negligible*.

In the preceding analysis, criteria have been developed on the basis of an elevation in the existing ambient equivalent noise level. This concept is well defined and well supported in the literature for frequently occuring events. Specific comparison may be applied between the procedure utilized in this analysis and that utilized by the State of California for aircraft operations (SENEL). On this basis, the finding of *negligible* impact is fully consistent with the available literature.

REFERENCES

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2. Kamperman, Geo. W. *"Ways to Weigh Noise Outdoors,"* Noise Control Engineering, Vol. 1, No. 1, Summer 1973.

3. Schultz, Theodore J., *"Community Noise Ratings,"* Applied Acoustics, Supplement No. 1, 1972; Applied Science Publishers, Ltd., London.

4. EPA, *"Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety,"* ONAC Draft, January 1974.

5. *"Public Health and Welfare Criteria for Noise,"* Environmental Protection Agency, 550/9-73-002, July 27, 1973.

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10. EPA, *"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances,"* December 1971.

11. Gordon, et al, *"Highway Noise - A Design Guide for Highway Engineers,"* National Cooperative Highway Research Board, National Research Council, National Academy of Sciences, Washington, D.C. (1971).

NOVATO BUS TERMINAL
MEASUREMENT SITE LOCATION

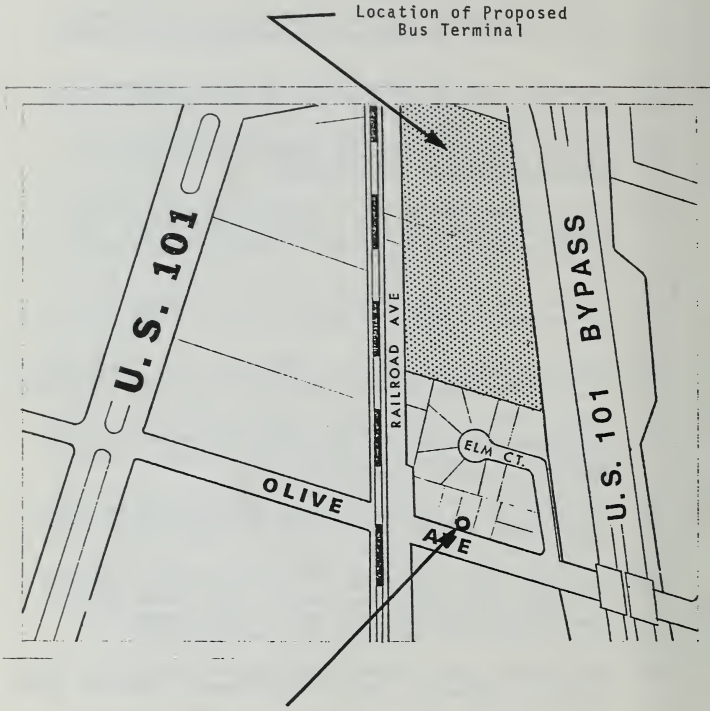


FIGURE II

DATA ACQUISITION SYSTEM

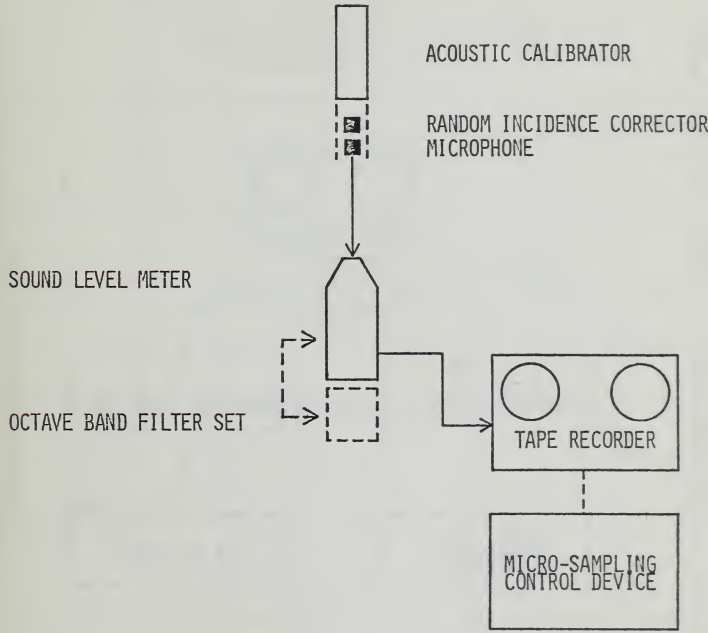
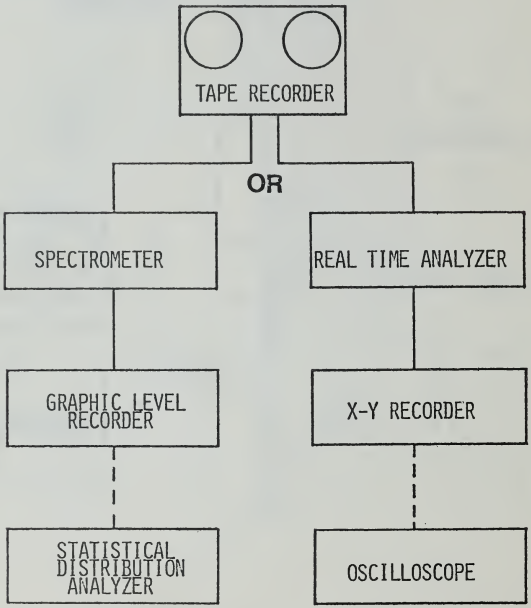


FIGURE III

DATA REDUCTION SYSTEM



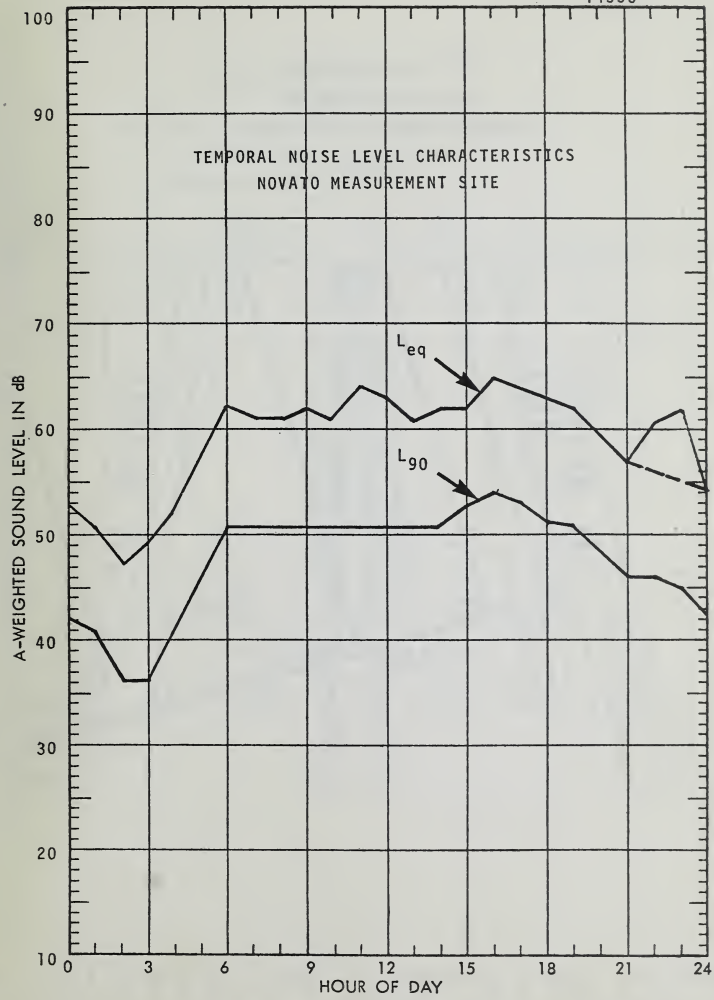
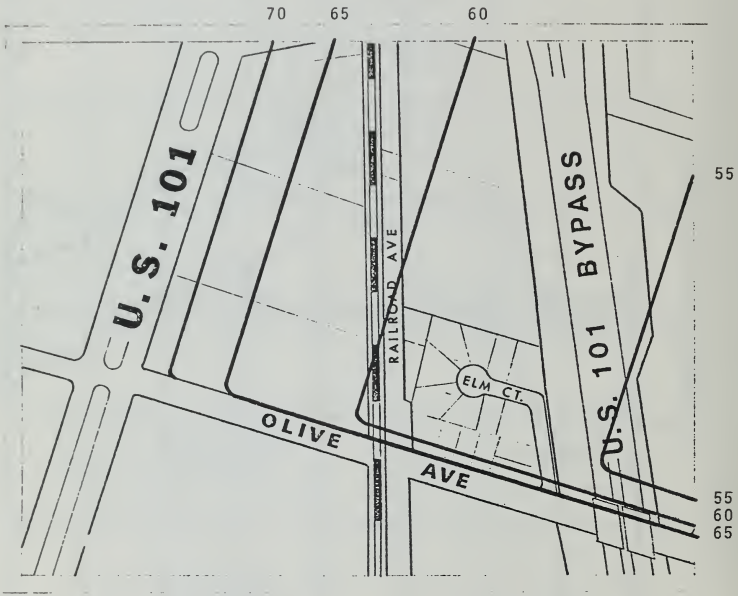

TEMPORAL NOISE LEVEL CHARACTERISTICS
NOVATO MEASUREMENT SITE
L_{eq}
L_{90}
A-WEIGHTED SOUND LEVEL IN dB
HOUR OF DAY
100
90
80
70
60
50
40
30
20
10
0
3
6
9
12
15
18
21
24

FIGURE IV

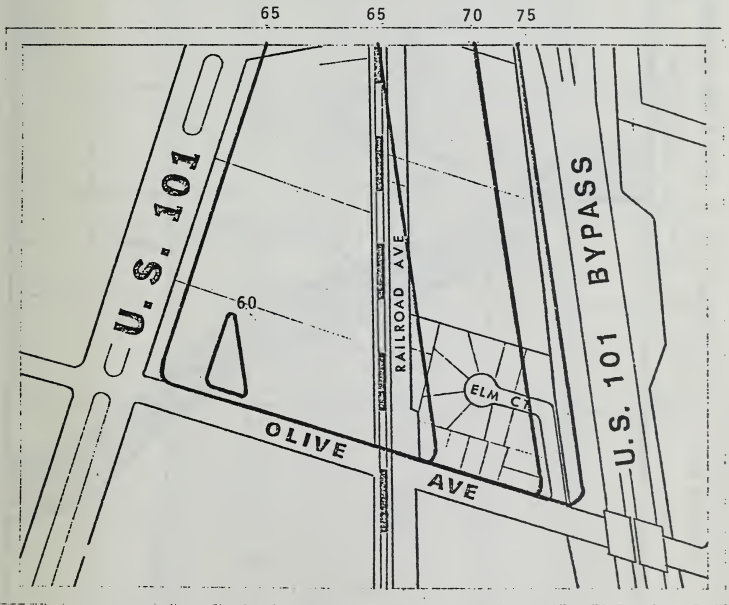
NOVATO BUS TERMINAL

EXISTING EQUIVALENT
DAY-NIGHT WEIGHTED NOISE LEVELS
(L_{DN})



NOVATO BUS TERMINAL

PROJECTED EQUIVALENT DAY-NIGHT WEIGHTED
NOISE LEVELS (L_{DN}) AFTER
OPENING OF U.S. 101 BY-PASS



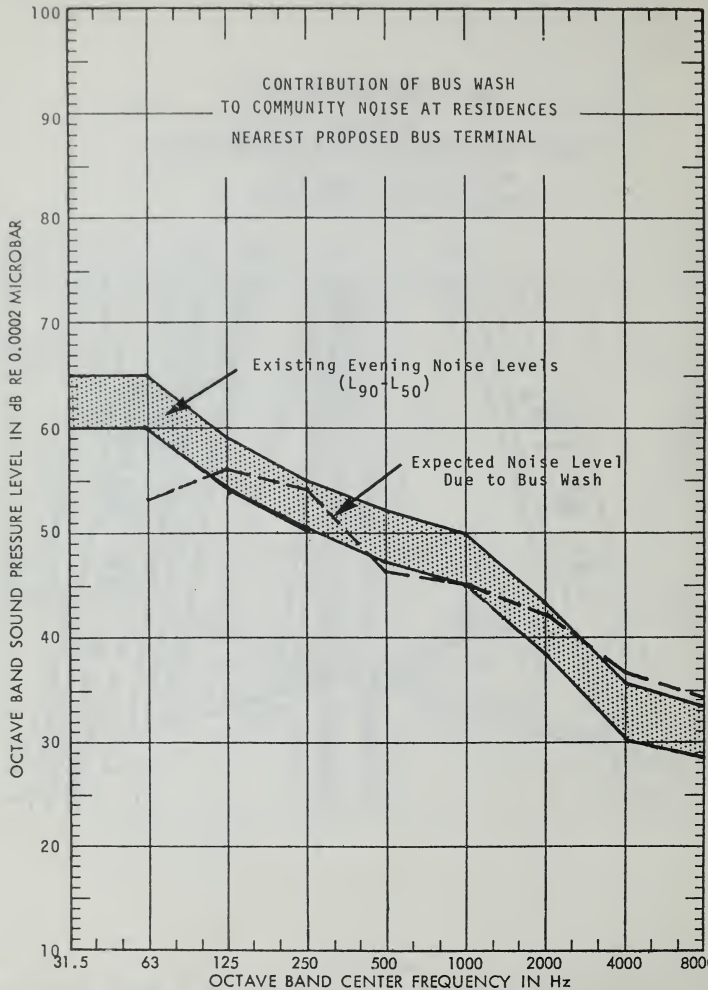
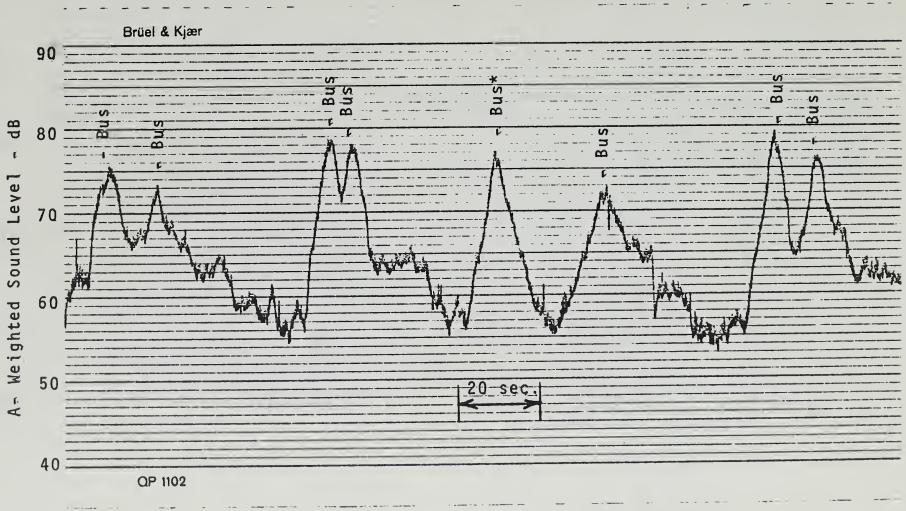

CONTRIBUTION OF BUS WASH
TO COMMUNITY NOISE AT RESIDENCES
NEAREST PROPOSED BUS TERMINAL
Existing Evening Noise Levels
(L_{90}-L_{50})
Expected Noise Level
Due to Bus Wash
OCTAVE BAND SOUND PRESSURE LEVEL IN dB RE 0.0002 MICROBAR
100
90
80
70
60
50
40
30
20
10
31.5
63
125
250
500
1000
2000
4000
8000
OCTAVE BAND CENTER FREQUENCY IN Hz

FIGURE VII

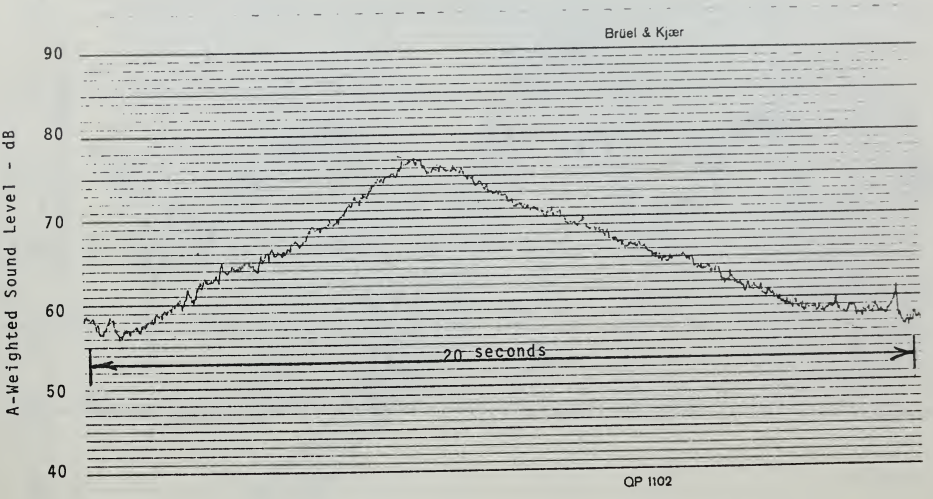


Golden Gate Bus Roadside* Noise Levels

*Measured at a distance of
50 feet from center line
of road

FIGURE VIII

Novato Bus Terminal
Acoustic Analysis
BBN #145500



Typical Single Bus Pass-By

FIGURE IX

Appendix 3

The Potential Impact of the Bus Maintenance Facility at Novato on Climate and Air Pollution

THE POTENTIAL IMPACT OF THE BUS MAINTENANCE FACILITY AT NOVATO ON CLIMATE AND AIR POLLUTION

by

Albert Miller

Consulting Meteorologist

April 15, 1974

Table of Contents

1. The potential impact on climate and air pollution

There are two principal ways in which a development might affect the climate and "air quality" of an area: (a) Changes in the existing characteristics of the earth's surface affect the exchange of heat and momentum between it and the air above it. Both the temperature and movement of air, particularly in the lowest 50 feet of the atmosphere, are largely determined by the characteristics of the underlying surface. (b) Pollutants and heat injected into the air are, in themselves, climatic changes; they may induce further change by altering with the natural heat exchange processes. In addition, of course, pollutants are themselves considered to be undesirable air constituents.

This report considers the influence of the proposed development on the atmospheric environment brought about by (a) changes in the physical properties of the ground surface and (b) emissions of pollutants and heat into the air. It should be stressed that this is not a "research" report, but an appraisal of the effects, based on existing climatological and air pollution data. No "on-site" measurements have been made. The evaluation of this development's effect on climate and smog is stated as a function of distance from the development, or elements within it, since the potential magnitude of the impact tends to be "diluted" as one moves away from the source. Thus, a one square mile development

might produce a significant change within a distance of a mile or two but the climatic change may be undetectable at a distance of 10 miles. Similarly, the air pollution contribution of a single factory or automobile may be undetectable when diluted by the atmosphere over an entire county but may be noticeable close to the source when atmospheric conditions are right.

Since there are no established standards for evaluating the significance of predicted climatic changes, these must be considered in a qualitative fashion. However, in the case of air pollution, there are State and Federal Air Quality Standards; the conclusions of this report will be based on the effect of project-generated air pollution on meeting these standards.

2. The land use plan

According to data supplied by Madrone Associates, the Bus Maintenance Facility of the Golden Gate Bridge Highway and Transportation District will have the following characteristics that are pertinent to this report:

(a) The proposed facility will occupy approximately 5-1/2 acres located between Highway 101 and Railroad Avenue in the town of Novato. Most of the surface will be covered with asphalt and construction, not significantly different than much of the immediate surrounding area.

(b) Emissions into the atmosphere

Since no manufacturing is planned for the development the only heat generation will be that used for space heating. In this particular development, even space heating will be extremely small.

The only significant emissions for this particular development will be that generated by bus and automobile traffic and from fuel storage (24,000 gal of diesel oil) for the buses. Approximately 3000 gallons of water will be used daily for washing buses; however, less than 10% is typically evaporated so that the resulting cooling and increased relative humidity in the atmosphere should be almost undetectable beyond the limits of the property line and there should be no increase in the incidence of mist.

The bus terminal will have parking space for 66 buses and 64 automobiles. The terminal will provide service only on weekdays, when about 35 buses will be in service, consuming about 825 gal. of diesel fuel per day. There will be 57 departures and 57 arrivals daily, with the peak hours occurring between 6 and 7 a.m. (21 departures) and between 6 and 7 p.m. (17 arrivals). The emission rates for various contaminants and sources are given in Table 1. Automotive emission rates for all the types of pollutants generated vary greatly by model, year, condition, and speed of an individual vehicle, as well as the effectiveness of any controls that may be installed. At the present time, California and EPA standards for the principal effluents from 1974 model automobiles are: 3.2 grams/mile for hydrocarbons (HC), 34 grams/mile for carbon monoxide (CO), and 3.1 grams/mile for oxides of nitrogen (NO_x). (For 1975 models, these will be 1.5, 15, and 2, respectively.) However, most studies of vehicle emissions indicate that average prevailing emissions are at least double these standards. For the purposes of this study, the average current emission rate of carbon monoxide for automobiles has been taken to be 65 grams/mile for a vehicle moving at 15 mph, decreasing to 45 grams/mile at a speed of 35 mph (see Fig. 1). For 1980 and later model vehicles, it is projected that the CO emission rate will drop to 9 grams/mile (15 mph) and 5 grams/mile (35 mph). However, CO is probably the easiest of the emissions to control.

Table 1. Emissions of Pollutants by Terminal-Related Sources.

Source	CO			NO_x			HC		
	Rate Factor[1]	Daily[2]	Peak Hour[3]	Rate Factor[1]	Daily[2]	Peak Hour[3]	Rate Factor[1]	Daily[2]	Peak Hour[3]
. Buses, within terminal	102 gm/ gal	8 mg/sec	74 mg/ sec	168 gm/ gal	13 mg/ sec	122 mg/ sec	17 gm/ gal	1.4 mg/ sec	12 mg/ sec
. Buses, along Olive St.	22 gm/ mi	.006 mg/ ft/sec	.02 mg/ ft/sec	34 gm/ mi	.003 mg/ ft/sec	.038 mg/ ft/sec	4 gm/mi	.001 mg/ ft/sec	.004 mg/ ft/sec
. Buses, total, including travel enroute	-	85,200 gm/day	16,860 gm/hr	-	140,300 gm/day	27,700 gm/hr	-	2,850 gm/ day	560 gm/ hr
. Automobiles, along Olive St.	65 gm/ mi	.043 mg/ ft/sec	.205 mg/ ft/sec	5 gm/ mi	.003 mg/ ft/sec	.015 mg/ ft/sec	9 gm/mi	.006 mg/ ft/sec	.028 mg/ ft/sec
. Diesel fuel storage and working loss	-	-	-	-	-	-	5.2 kg/ 10^3 gal/ day	4,600 gm/ day	878 gm/ hr

. Based on current (1972) average emission rates for diesel buses and automobiles. If projected rates are achieved (effective controls), these rates will be reduced to about one-fourth of the values given.

. Average source strength throughout day.

. Average source strength during peak traffic hours (6-7 a.m. and 6-7 p.m., weekdays).

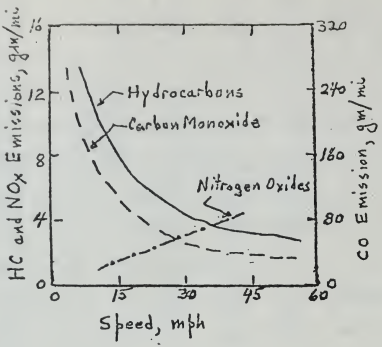


Fig. 1. Emissions of carbon monoxide, hydrocarbon, and nitrogen oxide as a function of vehicle speed.

The hydrocarbon (compounds of carbon and hydrogen) emission is somewhat similar to that of CO, depending on speed, model, and condition of the vehicle. A typical emission rate is about 9 grams/mile; it is projected that this rate will be reduced to less than 2 grams/mile. In contrast, NO_x emissions tend to increase with speed and it is much less likely that these can be brought down to standards in the future; the current average is probably about 5 grams/mile, and it would appear unlikely to reach less than 2 grams/mile.

The emissions for diesel buses are based on average emissions for 1972 models, as reported by EPA. Although CO, NO_x, and HC are the principal emissions, other pollutants include sulfur oxides (about 12 grams per gallon of fuel or 2.4 gm/mi) and particulates (about 6 grams/gal. or 1.2 gm/mi).

The source strengths computed in Table 1 for traffic associated with the terminal were obtained by multiplying the number of vehicles per unit time (based on proposed bus schedule) by the emission rate for an average vehicle. Item 3 in Table 1 gives the total emissions due to bus operations. For purposes of comparison, the normal peak hour traffic along U.S. 101 is about 9,000 vehicles per hour, now generating about 75.6 grams/ft/hr of CO. Thus, the total CO generated by all the buses over their entire travel routes is equivalent to about 225 feet of freeway. The terminal itself and the adjoining access road (Olive St.) will generate CO at a rate equivalent to about 4 feet of freeway.

3. The climate of the region

The climatic setting of the area must be considered in evaluating the changes that might be caused by a development as well as the levels of air pollution that might be produced. The dominant factor that determines the climates of the entire San Francisco Bay Area is its proximity to the Pacific Ocean. The large scale flow of air is such that its path is almost invariably from the ocean. This maritime influence, which tempers the climate, falls off sharply with distance from the ocean and bay waters.

To illustrate, the mean monthly temperature over the Farallon Islands ranges between 51°F (January) and 55°F (October); in the city of San Francisco, the mean temperature ranges between 51°F and 62°F (Table 2A); while at Hamilton Air Force Base, 46°F to 66°F (see Table 3A). The annual temperature range at Novato is a little greater than that at Hamilton Air Force Base - between 44° and 67°F.

The hills to the west of Novato play an important role in channeling the air flow and thus the climate of the area. During the summer half of the year - May to October - when there are few storms and the flow along the Pacific coastline is almost invariably from the northwest, much of the marine air reaches Novato via the Golden Gate, rather than directly from the coast. This is illustrated by the winds at Hamilton

(Table 3B) and San Francisco (Table 2D): In July, the dominant wind direction at San Francisco is from the west but at Hamilton Air Force Base, it is from the southeast.

The typical daily cycle of flow in summer is as follows, which is illustrated by the wind data of Tables 2 and 3: During the morning, oceanic air surges through Golden Gate and over the San Francisco Peninsula as the land begins to warm up. When it reaches the San Francisco Bay, it splits into two streams, one heading southward and the other northward into San Pablo Bay. At Novato, this stream is typically moving from the southwest or south-southwest. The northward-moving stream spreads laterally so that the wind speed is considerably reduced when the air reaches the northern coast of San Pablo Bay from the southeast. This flow (and the southeast winds at Novato) increases until late afternoon then diminishes and is replaced by a weak reverse flow (northwesterly winds at Novato) after nightfall.

Sometimes, marine air does penetrate the hills directly from the Pacific coastline in summer. In these cases, the direction during the day is from the northwest, reaching a peak speed in late afternoon. During the night and early morning, the wind is generally light (less than 5 mph), regardless of the circulation pattern that prevails and is usually from the northwest.

Table 2. Climatological Data at San Francisco.

	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
A. Monthly Mean Temperature (°F)												
Mean Max.	55.8	58.6	60.7	61.9	63.4	65.0	64.3	64.9	68.9	68.3	63.7	57.5
Mean Min.	45.5	47.3	48.6	49.5	51.3	53.1	53.3	53.9	55.1	54.4	51.0	47.4
Mean	50.7	53.0	54.7	55.7	57.4	59.1	58.8	59.4	62.0	61.4	57.4	52.5
B. Monthly Mean Rainfall (Inches)												
Precip.	4.55	3.66	2.93	1.44	0.63	0.14	0.01	0.04	0.22	0.89	2.00	4.27
C. Prevailing Wind												
Dominant Direction:	N	W	W	W	W	W	W	W	W	W	W	N
Mean Wind Speed (mph):	6.7	7.5	8.5	9.5	10.4	10.9	11.2	10.5	9.1	7.6	6.3	6.5

(Mean speed, year: 8.7 mph)

D. Annual Frequency of Wind Direction

Direction:	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
Frequency, %:	1.3	1.2	2.9	2.6	3.0	2.6	4.1	2.7	3.3	3.0	4.8	5.5	18.7	21.8	14.2	1.7	6.8
Mean Speed, mph:	9.2	8.1	6.8	6.4	6.2	7.0	7.1	7.5	7.3	11.8	9.0	10.8	13.2	14.0	12.1	10.3	-

Table 3. Climatological Data at San Rafael (Hamilton AFB), 1939-1970.

A3 (11)

	ANN.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
A. Monthly Mean Temperature (°F)													
Mean Max.	67.6	53.4	58.2	61.8	66.3	70.8	76.2	78.8	78.4	78.7	72.3	62.4	54.4
Mean Min.	46.1	38.7	41.4	42.4	44.5	47.8	51.3	51.9	52.0	51.5	48.2	43.4	40.1
Mean.		46.2	50.0	52.3	55.5	59.4	63.8	65.5	65.3	65.2	60.4	53.0	47.4
B. Monthly Mean Rainfall (inches)													
% of days	16.0	36.3	32.3	28.3	19.4	9.7	2.6	0.3	1.6	2.8	11.6	24.3	32.9
$\bar{R}$(in)	27.54	6.55	4.57	3.13	1.84	0.40	0.19	0.00	0.04	0.17	1.64	3.43	5.5
C. Frequency of Rainfall, Fog, and Obstructions to Visibility (% of Hourly Observations)													
Precip.		15.6	12.0	9.7	5.9	2.5	1.1	0.2	0.4	0.8	3.6	9.3	14.1
Fog		29.5	16.2	4.7	3.3	2.3	0.8	1.9	2.5	3.8	7.8	17.9	30.8
oke &/or Haze		11.1	6.3	2.1	1.4	1.3	1.0	0.8	1.4	4.2	7.1	12.1	12.5
s. to vision		38.5	21.2	6.6	4.6	3.5	1.7	2.6	3.8	7.8	14.5	28.6	40.9
D. Monthly Mean Cloudiness (% of Sky Cover)													
Sky Cover all hours)		6.0	5.7	5.0	4.5	3.9	3.0	2.0	2.5	2.4	3.5	5.0	6.3

Table 3 Climatological Data at San Rafael (Hamilton AFB), 1939-1970.
(continued)

E. Annual Frequency of Wind Direction

Direction:	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Calm
Frequency, %:	4.3	1.2	1.4	1.0	4.8	3.9	8.8	3.5	4.1	3.3	4.4	2.0	4.9	4.9	10.4	5.6	31.6
Mean Speed, Knots:	5.3	6.2	5.3	5.8	6.3	6.5	7.4	8.4	7.1	7.8	6.6	7.1	6.5	8.7	7.5	6.8	-

Mean annual speed: 4.8 knots.

F. Annual Frequency of Wind Speeds

Speed, Knots:	Calm	1-3	4-6	7-10	11-16	17-21	22-27
Frequency, %:	31.6	16.4	17.6	23.0	9.8	1.3	0.3

A3 (12)

G. Mean Speed in Morning and Evening

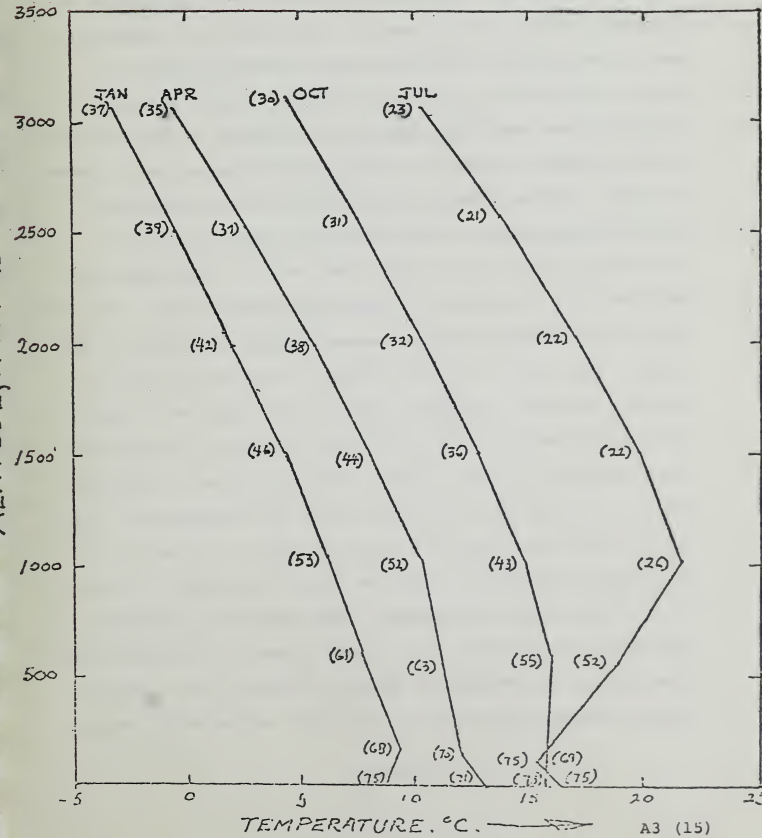
Month:	January		April		July		October	
	Mean (Knots)	Dominant Direction	Mean (Knots)	Dominant Direction	Mean (Knots)	Dominant Direction	Mean (Knots)	Dominant Direction
5-8 am (PST):	3.9	E	3.3	NW	2.1	N	2.3	NW
9-11 am (PST):	5.1	E	6.1	SE	6.9	SE	4.7	SE
3-5 pm (PST):	5.8	E	9.1	NW	9.4	SE/NW	7.0	NW/SE
5-8 pm (PST):	5.1	E	6.1	SE	6.9	SE	4.7	SE

During the winter months (November to March), the daily wind cycle is not nearly as regular. When storms are approaching, the winds are typically from the SSW to SSE sector and, as the storms pass, turn to NW. There are about 58 days per year with rain, most of which (53) occur during the November-to-April rainy season. Although the average wind speed is a little less in winter than in summer, the strongest peak speeds occur in winter during the passage of storms. Very weak winds and calm occur with a very high frequency in the fall and winter months in the intervals between storms. Thus, in winter, moderate wind speeds - associated with storms - are interspersed with periods of several days of very weak winds. Summer, in contrast, has a well-defined diurnal variation of wind speed, with comparatively-little day-to-day changes.

The high incidence of light winds (less than 3 knots) and calm (almost 50% of the time on an annual basis, mostly between December and February), and the relatively high incidence of fog, haze and smoke in the Fall and Winter (October to February, inclusive) indicate that atmospheric dispersion in this region is often quite poor. The poor dispersion conditions occur primarily in the Winter (December to February, inclusive). There are no vertical temperature soundings available in the immediate vicinity

that might yield statistics on the depth of vertical mixing of the atmosphere. The Oakland temperature soundings (Figure 2) are not representative of the Novato area. However, simultaneous temperature measurements made atop Mt. Tamalpais and in San Francisco, plus occasional aircraft soundings that have been made provide a basis for estimating the normal conditions near Novato. It is likely that ground level temperature inversions are more frequent at Novato than they are at Oakland because there is considerable drainage of cold air from the hills at Novato.

Fig. 2. Mean Monthly Temperature Soundings at Oakland at 7 p.m. (PST) [1946-1955]. (Values in parentheses: Mean Relative Humidity.)



4. Air pollution in the region

The atmospheric circulation described above plays a very important role in air pollution since it determines the rate at which man-made contaminants are dispersed. During certain periods, particularly in the Fall and Winter, the atmospheric conditions sometimes produce a high pollution potential. Table 4 gives the air quality standards for contaminants produced from automobile emissions. There is no air pollution sampling station close to Novato, but inferences can be drawn from the stations located at San Rafael and San Francisco. Table 4 also summarizes the incidence of high pollutant concentrations during the past four years at San Rafael and San Francisco, and Figure 3 gives the average monthly variation of high-hour concentrations during a four year period at San Rafael. As can be seen from Figure 3, the high pollution months for carbon monoxide, oxides of nitrogen, and hydrocarbons are September to March while the highs for oxidants occur between June and October. The difference in behavior between oxidants and the other species of contaminants is due to the fact that oxidants are formed from the other species and atmospheric oxygen under the action of sunlight, which is most intense during the summer. (For comparison purposes, the mean high-hour oxidant level at San Rafael is generally higher than that at San Francisco, which is generally the lowest in the San Francisco Bay Area.) For other contaminants, e.g.,

CO and NO_2, San Francisco has considerably higher values than does San Rafael. These other species are highest when the dispersive power of the atmosphere is least. This occurs in winter, when there are many periods of weak winds and mixing in the vertical is least due to the frequent occurrence of temperature inversions near the surface, particularly in the morning. Thus, the peak CO and NO_x concentration occurs in the winter at about 8 a.m. and between 6 and 10 p.m.; these times coincide with the peak traffic and minimum capability of the atmosphere to disperse contaminants. Oxidants, on the other hand, reach their peak concentration near midday in summer and early fall.

In summary, the levels of contaminants at Novato should be close to those observed at San Rafael.

Table 4. Standards for Automotive-Related Air Contaminants and Observed Concentrations at San Francisco and San Rafael.

Pollutant	Averaging Period	Standards: California	Standards: Federal*	Observed at SF and SR: No. Days Exceeded Calif. Standard in: 1970 SF	1970 SR	1971 SF	1971 SR	1972 SF	1972 SR	1973 SF	1973 SR	Maximum Value in: 1970 SF	1970 SR	1971 SF	1971 SR	1972 SF	1972 SR	1973 SF	1973 SR
Suspended Particulates	Annual+	60 µg/m³	60 µg/m³	0	0	0	0	0	0	0	0	NA	44	NA	46	NA	NA	NA	NA
	24 hours	100 µg/m³	150 µg/m³	NA	4	1	6	1	5	7	3	NA	136	128	125	101	113	180	110
Carbon Monoxide	12 hours	10 ppm	-	-	0	-	0	-	0	-	0	-	8.2	-	7.8	-	7.6	-	7.5
	8 hours	-	9 ppm	1	0	9	0	10	0	4	0	10	NA	10	NA	10	NA	-	NA
	1 hour	40 ppm	35 ppm	0	0	0	0	0	0	0	0	25	19	26	18	24	18	15	17
Oxidants	1 hour	0.10 ppm	0.08 ppm	6	41	3	21	1	5	2	2	.20	.24	.19	.18	.08	.17	.12	.12
Nitrogen Dioxide	Annual	-	0.05 ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1 hour	0.25 ppm	-	7	0	1	0	2	0	0	0	.42	.17	.27	.12	.33	.14	.21	.19
Lead	30 days	1.5 µg/m³	-	0.8 2.8	0.4 2.6	1.1 4.5	0.7 2.7	0.4 2.2	0.3 2.6	NA	NA	NOT AVAILABLE							
Hydrocarbons	3 hours (6-9 am)	-	0.24 ppm																

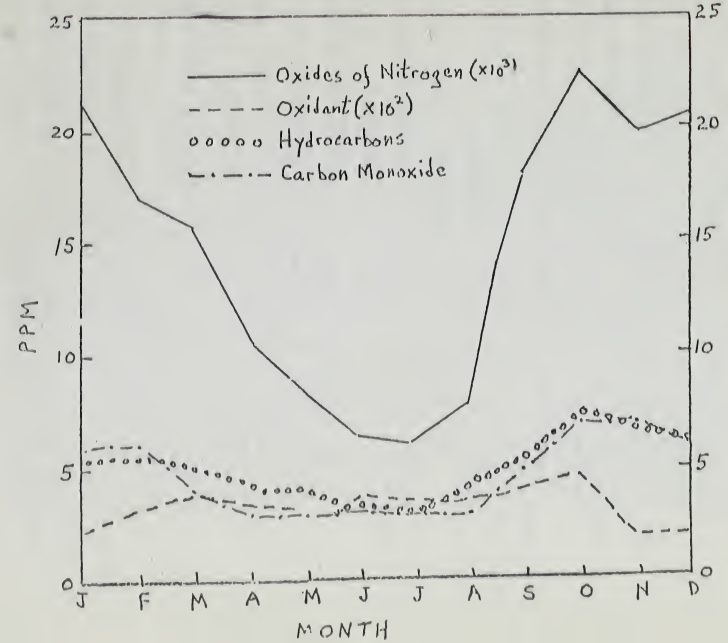
*Lower (secondary) standard, when prescribed.

+Geometric mean

ppm: parts per million

µg/m³: micrograms per cubic meter

Fig. 3. Mean of High Hour Concentrations of Pollutants at San Rafael (Oct. 1968-Sept. 1973).



5. Effect of proposed Novato Bus Terminal on climate and air pollution

The potential effects of developments on the atmosphere are of two kinds: (1) Changes in the earth's surface properties that influence the energy exchange between the surface and the atmosphere, and thus produce changes in such parameters as the air temperature and air movement. (2) Man-made emissions of heat and pollutants that can modify the climate or may be harmful and/or unpleasant in themselves. This report will evaluate each of these effects that might result from the proposed development.

The changed surface properties brought about by any development that may affect the atmosphere are, first of all, thermal characteristics. The atmosphere is heated (and cooled) largely through heat exchange at the earth's surface. Certain kinds of surfaces, like asphalt, heat up much more than do other surfaces, like grass or water, under the same intensity of solar radiation. Also, some surfaces, such as those of plants and water, dissipate a great deal of heat through evaporation.

Second, the surface "roughness" retards air flow. For example, the wind speed within city "canyons" is less than that over open fields, if there is no temperature difference between city and countryside.

We shall consider separately local ("small scale") effects - those within a few miles of the bounds of the project - and regional ("large-scale") effects (beyond 4 or 5 miles). This is done because the diffusion of heat and pollutants in the atmosphere is such that typically the concentration of these falls off very sharply with distance downwind of the source. Except when dealing with an especially strong source (e.g., a hot fire) or unusual meteorological conditions, the effects are typically undetectable at a distance of three or four "project lengths" (in this case, the typical length is about 1/4 mile) downwind from the project. (Although each individual project's effect may be undetectable, there is, of course, the cumulative effect of many projects. We are here concerned with only this project's impact.)

(a) Atmospheric concentrations of pollutants

The atmospheric concentration of each contaminant at various distances from the source can be computed from the expected source strength data of Table 1 through application of Gaussian plume diffusion equations. The rate of dispersion (dilution) of pollutants emanating from a source depends on such atmospheric properties as wind speed, turbulent mixing, and vertical depth of air mixing. These parameters vary greatly throughout each day and from day to

day. They can be determined from surface wind measurements and vertical soundings of temperature and wind. Since there are no such data available at the site, we have extrapolated wind measurements obtained at Hamilton Air Force Base (Table 3) to the Novato site.

The carbon monoxide, oxides of nitrogen, and hydrocarbon concentrations downwind from the source area (within the terminal and along adjacent Olive St.) have been computed for the normal peak traffic hour and the normal daily average traffic. The results at various distances downwind are presented in Table 5. Since the poorest dispersion is likely to occur in the early mornings of the fall or winter, extreme meteorological conditions (poor mixing) were assumed to occur during the peak traffic hours; such conditions are not likely to occur more than 60% of the time, even during the worst month (December). The results show that even under extreme meteorological conditions (near sunrise and sunset in fall and winter) the contributions of the project to the concentrations of CO and HC are barely detectable at distances beyond 100 feet from the boundary. Within the terminal area the concentration of CO under extreme conditions could reach 1-2 ppm, which is small compared to ambient levels during such periods. Under normal meteorological conditions (e.g., midday in summer or spring), all pollutants will be at barely detectable levels.

Table 5. Computed Pollutant Concentrations (ppm) in Vicinity of Novato Bus Terminal.

A. Terminal

Distance downwind from property limits	Daily traffic; average meteorological conditions			Peak-hour traffic, meteorological cond (fall/winter)	
	CO	NO_x	HC	CO	NO_x
100 ft.	.01	.02	<.01	.12	.20
200 ft.	<.01	.01	<.01	.09	.16
300 ft.	<.01	<.01	<.01	.07	.13
500 ft.	<.01	<.01	<.01	.05	.10
1000 ft.	<.01	<.01	<.01	.03	.07
2000 ft.	<.01	<.01	<.01	.02	.04

B. Along Olive Street

Distance from street	Daily average traffic			Peak-hour traff	
	CO	NO_x	HC	CO	NO_x
100 ft.	.01	.03	.01	.18	.23
200 ft.	<.01	.02	<.01	.14	.18
300 ft.	<.01	<.01	<.01	.09	.15
500 ft.	<.01	<.01	<.01	.07	.12

6. Conclusions and recommendations

(a) The terminal will have an almost undetectable effect on the climate at a distance beyond a thousand feet from its boundaries. Even within the project the effects will be very small, e.g., not more than 1°F temperature change.

(b) The most serious problem is that of air pollution in a region where the potential for high levels of contamination is often great. Although the total contribution to air pollution is very small (and even that is probably smaller than that of the automobiles replaced by buses), during periods of very stable meteorological conditions the level of oxides of nitrogen may cause the standards for NO_2 to be exceeded at distances less than 100 feet during peak traffic hours (6-7 a.m. and 6-7 p.m.). This is most likely to occur at the southeast boundary of the terminal.

(c) Under average meteorological conditions, the emissions stemming from the terminal will never cause air pollution standards to be exceeded. Even under severe conditions, the CO and HC emissions by diesels will not cause an increase in the incidence of above-standard levels for these constituents.

(d) In order to reduce the emissions of NO_x within the terminal, buses should not be permitted to remain stationary with engines idling for more than 1 or 2 minutes. If this rule is followed, the NO_x levels predicted in the

vicinity of the terminal under severe conditions will be reduced to less than half.

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ODORS GENERATED BY THE NOVATO BUS MAINTENANCE FACILITY

(Addendum to impact report of April 15, 1974)

by

Albert Miller

Consulting Meteorologist

April 27, 1974

The principal malodorous substances in the emissions of diesel buses are the sulfur oxides and aldehydes (oxygenated hydrocarbons). Both of these emissions can be greatly reduced by proper engine care (more complete combusion in the combustion chamber of the engine, which will also eliminate the dark plume from the exhaust).

The typical diesel bus emits about 0.3 gram/mile of aldehydes and about 2.4 grams/mile of sulfur oxides (the latter assumes fuel containing 0.2% sulfur). Under severe meteorological conditions (poor atmospheric dispersion) during peak-hour traffic, the computed concentration of aldehydes within 100 feet of the terminal property line is less than .003 ppm and the computed concentration of SO_x is less than .015 ppm. With well-adjusted engines and a minimum of idling time in the terminal, these values could be reduced by more than half.

The detection threshold concentration for odors varies greatly among observers (noses). However, for SO_2 the lowest detectable concentration is about 0.5 ppm and for aldehydes about 0.02 ppm. Thus, neither of these substances should be detectable beyond 70 or 80 feet even under the worst conditions (poor atmospheric dispersion, peak-hour traffic). The odors will be most often detected within 30-40 feet of idling buses on early mornings with almost calm wind.

Appendix 4

Plant List for the Novato Bus Facility Site, April, 1974

Table I

COMMON NAME	SCIENTIFIC NAME
Grasses and Sedges:	
Ripgut	*Bromus rigidus*
Soft Chess	*B. mollis*
Downy Chess	*B. tectorum*
Foxtail Fescue	*Festuca megalura*
Semaphore	*Pleuropogon californicus*
Bluegrass (annual)	*Poa annua*
Bluegrass (perennial)	*Poa* sp.
Foxtail	*Hordeum leporinum*
Mediterranean Barley	*Hordeum Hystrix*
Perennial Ryegrass	*Lolium perenne*
Wild Oats	*Avena barbata*
Rabbitfoot Grass	*Polypogon monspeliensis*
Harding Grass	*Phalaris tuberosa* var. *stenoptera*
"Gnawed" Canary Grass	*Phalaris paradoxa*
Spike-rush	*Eleocharis acicularis*
Other Herbs:	
Knotweed	*Polygonum aviculare*
Dock	*Rumex crispus*
Sand Spurrey	*Spergularia rubra*
Common Mustard	*Brassica campestris*
Wild Radish	*Raphanus sativus*
Lupine (annual)	*Lupinus* sp.
Sweet Clover	*Melilotus indicus*
Bur-clover	*Medicago hispida*
Vetch	*Vicia* sp.
Broad-leaf Filaree	*Erodium Botrys*
Redstem Filaree	*E. cicutarium*
Cheese-weed	*Malva parviflora*
Sweet Fennel	*Foeniculum vulgare*
Common Plantain	*Plantago lanceolata*
Tarweed	*Madia* sp.
Bull Thistle	*Cirsium vulgare*
Thistle	*Carduus* sp.
Star Thistle	*Centaurea* sp.
Brass Buttons	*Cotula coronopifolia*

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